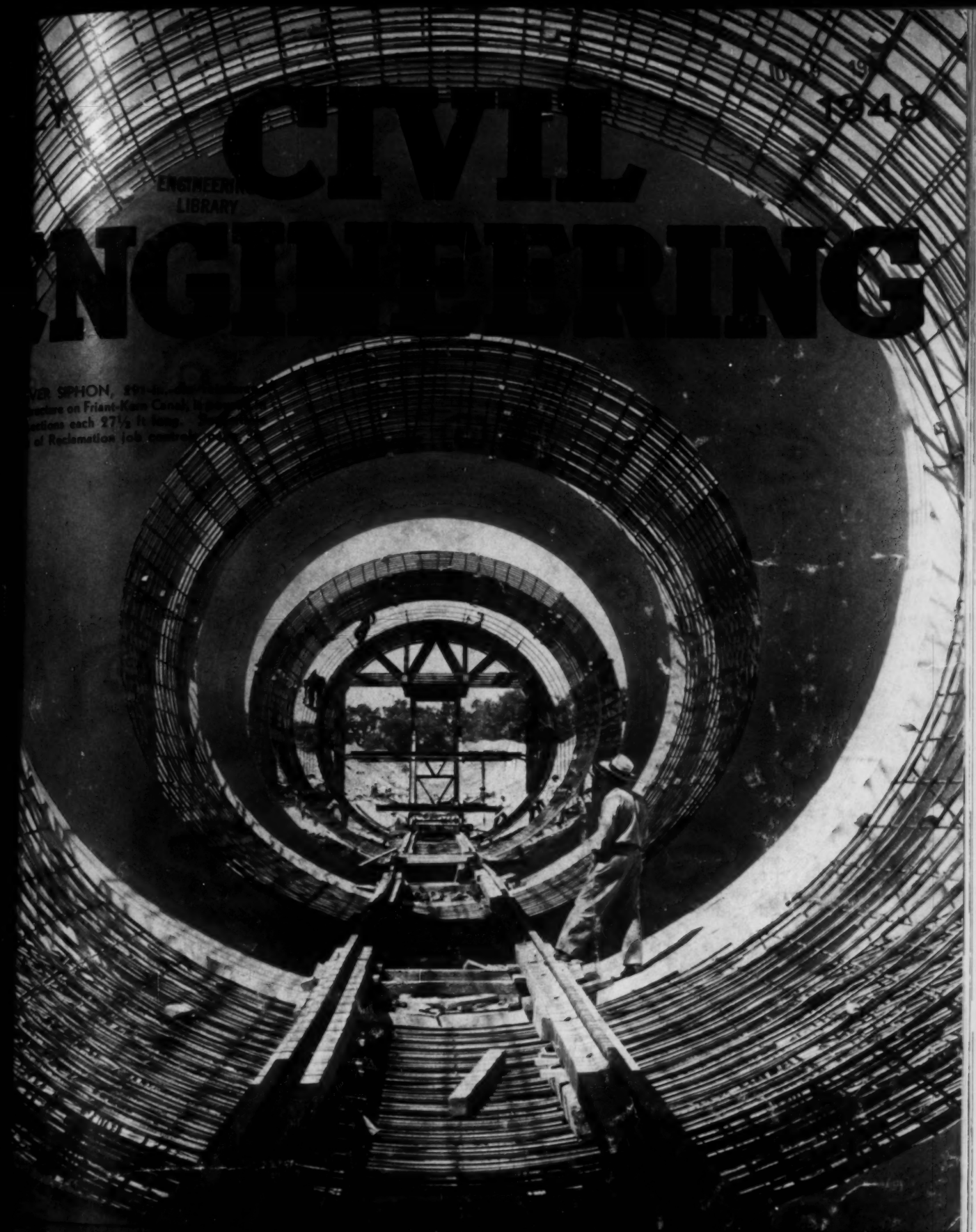
ENGINEERING
LIBRARY

CIVIL ENGINEERING

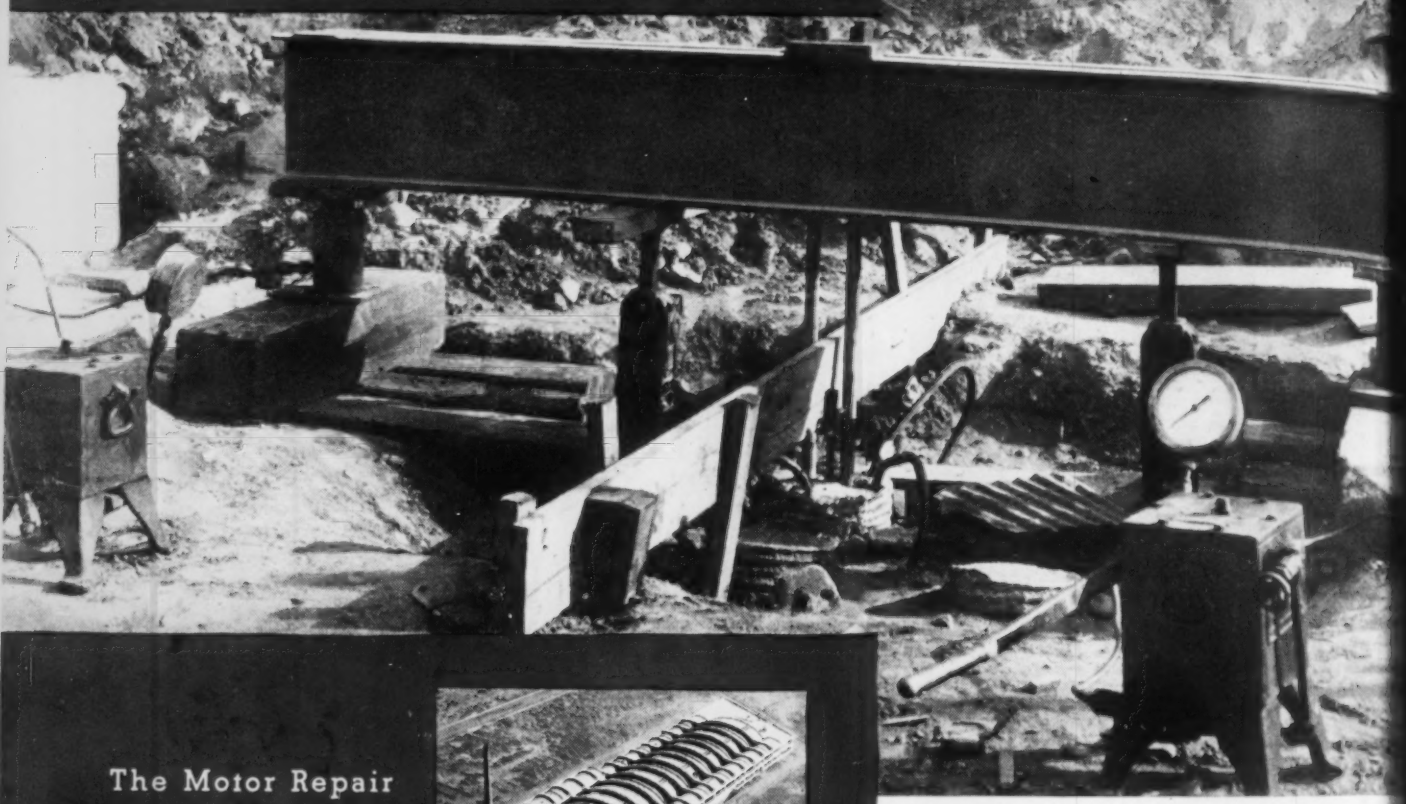
JULY 1948

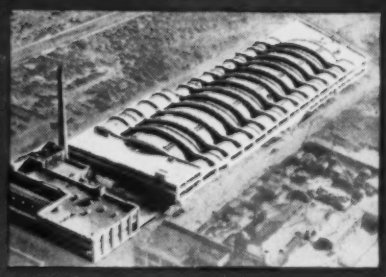


VER SIPHON, [illegible]
ecture on Friant-Kern Canal, [illegible]
ections each 27½ ft long.
of Reclamation job control[illegible]

Angeles' Hyperion Project Ends Beach Contamination—Alderson and Smith
-Speed Parkway Relieves Washington-Baltimore Traffic Congestion—Spalding
Army Engineers Report on German Superhighways—Gompertz
Los Alamos—The Town the Atom Is Building—Carey

Another Foundation by RAYMOND


TEST PILE
35 TON UPLIFT TEST
ON JOB FOR THE
FIRE DEPT. CITY OF NEW YORK
35TH AND 48TH AVE. LONG ISLAND CITY
CONTRACTOR
RAYMOND CONCRETE PILE CO.
140 CEDAR ST. N.Y. CITY
PILE LENGTH 29 FT. 2 IN
TOTAL UPLIFT DURING LOADING 0.080 INCHES
NO ADDITIONAL MOVEMENT FOR 24 HOURS



The Motor Repair Shop for the New York City Fire Department in Queens is supported by 651 Raymond Step-Taper Concrete Piles up to 36 feet in length. Some are vertical piles and some are battered and the design load per pile is 30 tons in direct bearing. In addition to the direct bearing load requirement, certain retaining walls in the construction of the building required some piles to be capable of withstanding an uplift force of 30 tons. In accordance with specifications prepared by the City, the Raymond Company satisfactorily demonstrated the uplift resistance of these piles by means of extensive tests.

Designed by New York City Department of Public Works. General Contractor: Corbetta Construction Co., New York.

51 YEARS — FOUNDED 1897 — OF PROGRESS

SCOPE OF RAYMOND'S ACTIVITIES

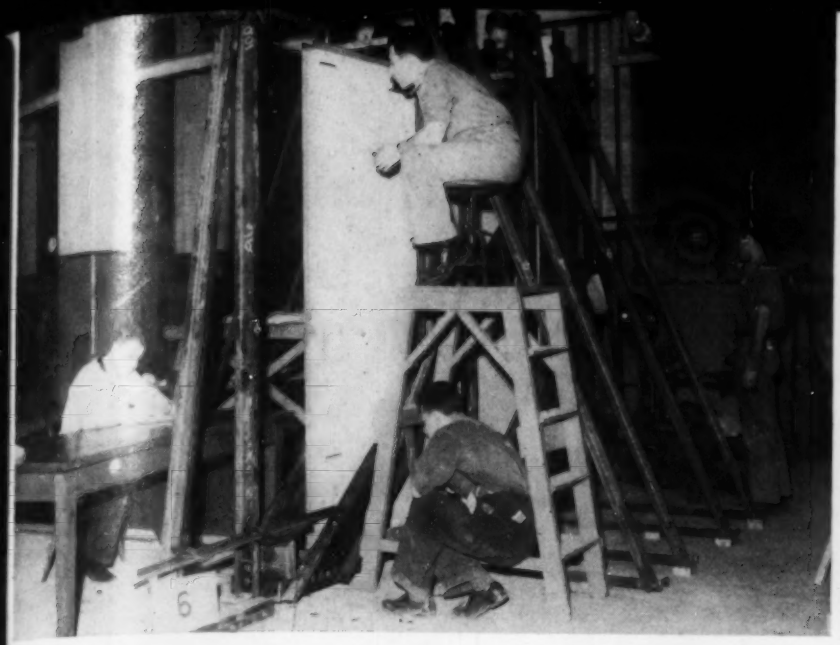
—includes every recognized type of pile foundation—concrete, composite, precast, steel, pipe and wood. Also caissons, construction involving shore protection, shipbuilding facilities, harbor and river improvements, borings for soil investigation.

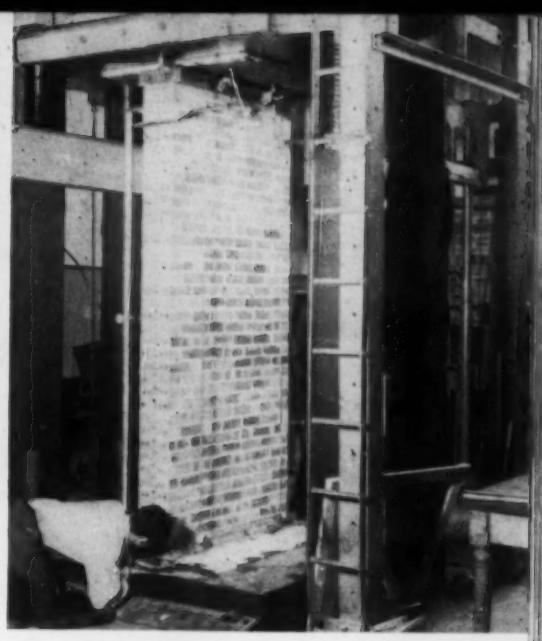
RAYMOND

CONCRETE PILE COMPANY

Branch Offices in Principal Cities of United States and Latin America

140 CEDAR STREET • NEW YORK 6, N. Y.





LOADS ARE APPLIED TO SPECIMENS which accurately reproduce most important structural parts of house. For each element, prescribed methods of loading in Bureau of Standards laboratory simulate actual loads under service conditions. In test (above, left) racking or shearing load applied to steel wall represents forces resulting at intersection of walls against which wind is blowing. Brick wall (above, right) is subjected to vertical compressive load in Bureau's ten-million-pound testing machine.

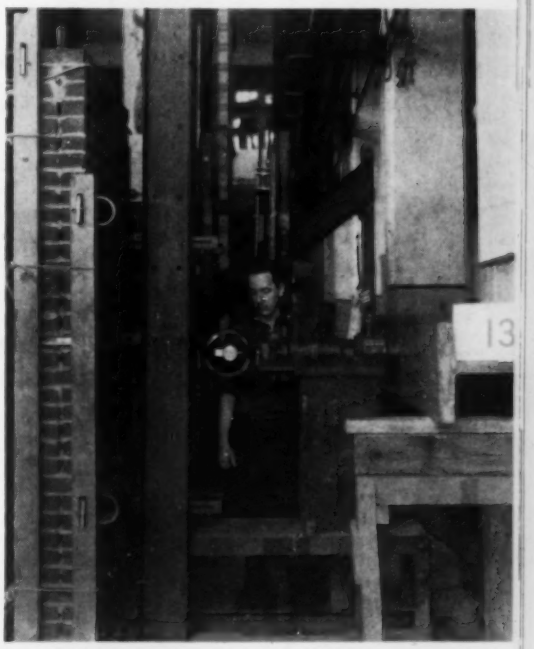
Engineering Principles Provide Logical Approach to Design of Houses

IN ITS EXTENSIVE research program on building materials and structures, the National Bureau of Standards has developed and applied an engineering approach to house design which promises substantial aid to the building industry. This approach, accomplished through application of accepted engineering principles, facilitates the use of unconventional materials and unusual methods of construction.

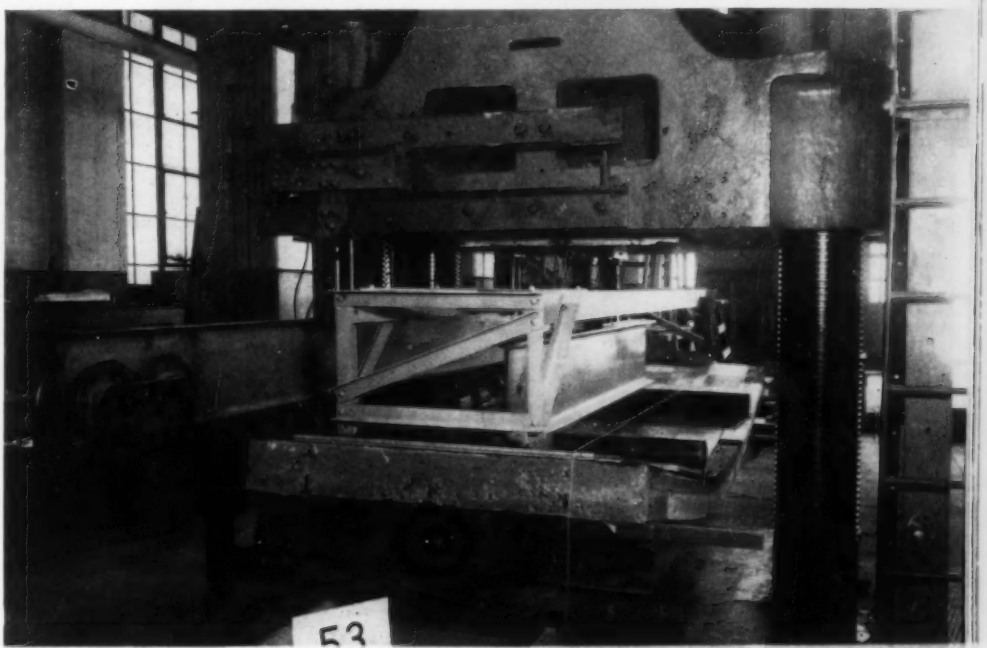
Building material is costly, as is the labor required to shape and fit it into place. Application of engineering principles to the design of houses presents a complete and logical method for determining allowable loads for walls, floors, and roofs; and makes possible the development of designs that have sufficient strength yet require a minimum amount of material and labor. This procedure is followed in the construction of all large engineering structures. Intensities of the service loads are first estimated; each material is then selected to serve a specific function and is so distributed as to provide structures of adequate strength at minimum cost. The vast fund of technical information on materials can be utilized similarly for the benefit of dwelling houses when applicable engineering principles and design practices are developed and used.

Suggested methods for designing small houses to have adequate strength without waste of material are described and illustrated in considerable detail in the recent Building Materials and Structures Report of

(*Continued on page 80*)

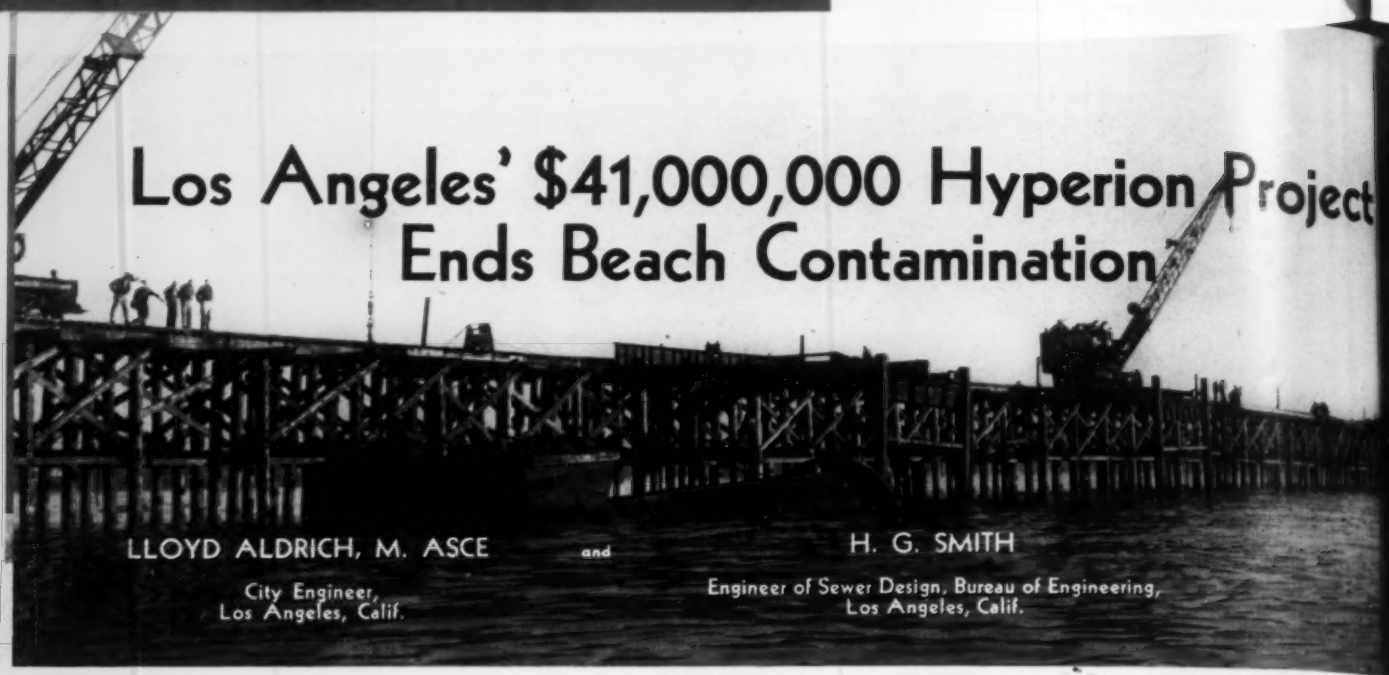


ENTIRE HOUSE ELEMENTS are subjected to tests which provide for transverse or bending loads, representing direct action of wind upon exposed faces. Here, brick wall undergoes transverse test. Proving ring is used for measuring applied load.



FLOOR AND ROOF CONSTRUCTION are required to withstand transverse loads caused by live and dead loads. Here ten-million-pound machine tests concrete-slab floor specimen which has 12-in. deflection under maximum load.

Los Angeles' $41,000,000 Hyperion Project Ends Beach Contamination



LLOYD ALDRICH, M. ASCE
City Engineer,
Los Angeles, Calif.

and

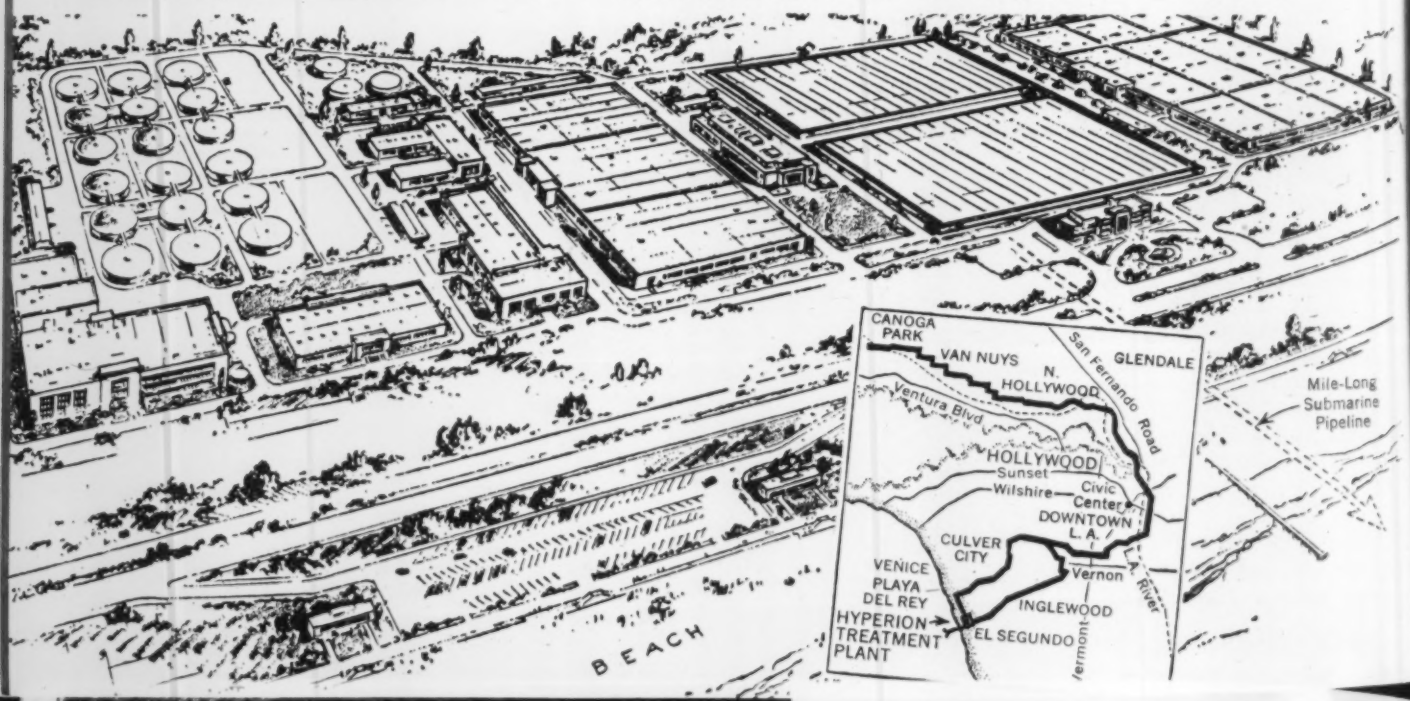
H. G. SMITH
Engineer of Sewer Design, Bureau of Engineering,
Los Angeles, Calif.

EARLY COMPLETION of the 41-million-dollar sewage disposal program now well under way will give Los Angeles one of the country's most modern and comprehensive treatment systems. The mile-long submarine outfall—an important feature in eliminating contamination of Los Angeles beaches—is now completed and work has begun on the headworks and primary treatment units of the high-rate activated sludge plant. Capacity will be provided for treating an average daily flow estimated at 245 million gallons, or 540 cfs, with 110 cfs of additional capacity in the headworks and primary settling tanks to provide for storm flows. The completed plant will treat the sewage from a population of 3,000,000 people, now discharged in a raw state into Santa Monica Bay. In this article, Messrs. Aldrich and Smith relate the events which led to the final decision on type of treatment. The design of the treatment plant, the method of clearing the site of high sand dunes and the design and construction of the new ocean outfall are described. The solution found for the vexing problem of financing is also presented.

CONSTRUCTION TRESTLE equipped with standard-gage track extends out entire mile length of submarine outfall. In foreground, 455-ton, 100-ft length of precast concrete pipe for offshore section is floated into final position where it will rest on concrete piers supported by steel piles. Bulkheads are still in place but one saddle tank has been removed.

NEXT TO CLIMATE, the beaches of Southern California are its greatest asset, yet for years the sewage of 90 percent of the City of Los Angeles, ten surrounding cities and a number of smaller areas supporting a present population of over two million people has been discharged raw into Santa Monica Bay. This sewage carries over 320 ppm of suspended solids after removal of 3 to 5 percent by screening. Considering the present 24-hour flow of 185 million gallons, these solids, including grease, amount to some 200 tons a day. Naturally a portion of this filth drifts along the coast for miles in both directions, polluting not only the bathing water but the beach sands to the high-tide line as well. While it has not been possible to trace any specific case of disease directly to bathing or contact

PERSPECTIVE SKETCH shows esthetic treatment planned for project as part of scheme for improving beaches for recreational purposes. Location of plant and outfall is shown in inset.—Courtesy Los Angeles Times and staff artist Charlie Owens.



STANDARD-TYPE MONITORS wash down 900,000 cu yd of sand a month (above, left) to prepare 88-acre site for activated sludge plant. System used for collecting and loading sand into pipelines for disposal employs sand surge pit and loading chamber (above, right) activated by 10,000-hp pumping plant. In center of surge pit is steel mixing chamber equipped with adjustable air-controlled gates which act as movable weirs and permit operator to control amounts of sand and water entering chamber. Thus operator governs sand load fed to main 28-in. discharge line extending up beach. View at right shows one of four monitors used in removing total of 14,000,000 cu yd of wind-blown sand which is being pumped to widen beaches for 6 miles north of Hyperion.

with beach sands, the California State Board of Health has considered the conditions as a source of potential danger and first urged and finally demanded that remedial measures be taken.

Probably no large city in the country has had more differences of opinion and discussions on the part of civic organizations, citizens and engineers as has Los Angeles since 1933, with regard to the location, type and method of financing of its sewage treatment plant.

In September 1940 the State Board of Health revoked the original permit issued in 1923, which granted Los Angeles the right to discharge screened sewage into Santa Monica Bay, on the ground that the city had violated the conditions of the permit. However, a temporary permit was granted with the understanding that the city would submit plans within a year for a proper type of treatment plant and would adopt a method of financing the project.

Early Studies Conducted

Detailed studies of the entire problem had been carried on for many years by the Bureau of Engineering and tentative plans prepared. For 15 months in 1937 and 1938 a pilot plant was operated, consisting of primary and secondary settling tanks with mechanical and chemical flocculation, continuing with multi-digestion and vacuum filtering. The results (*Sewage Works Journal*, Vol. XII, No. 4, 1940) indicated that Los Angeles sewage can be treated by normal methods.

In 1939, the City Engineer recommended to the Board of Public Works that a board of consulting engineers be appointed to make a general study of the problem and submit recom-

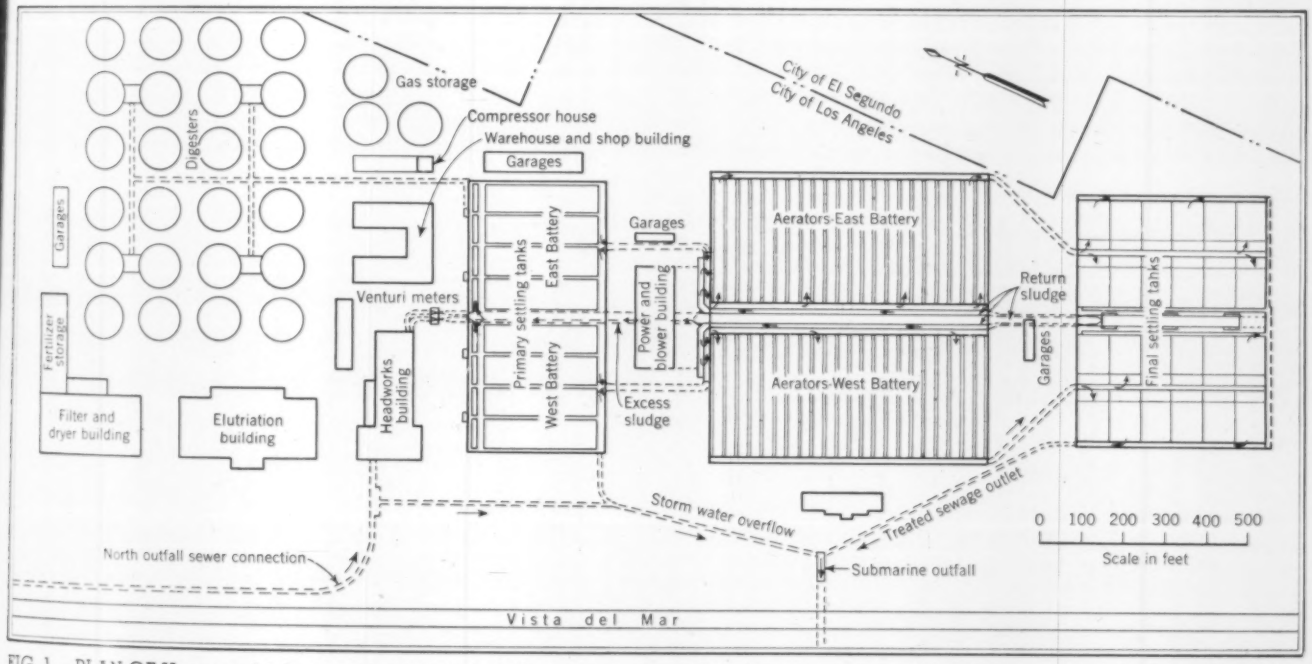
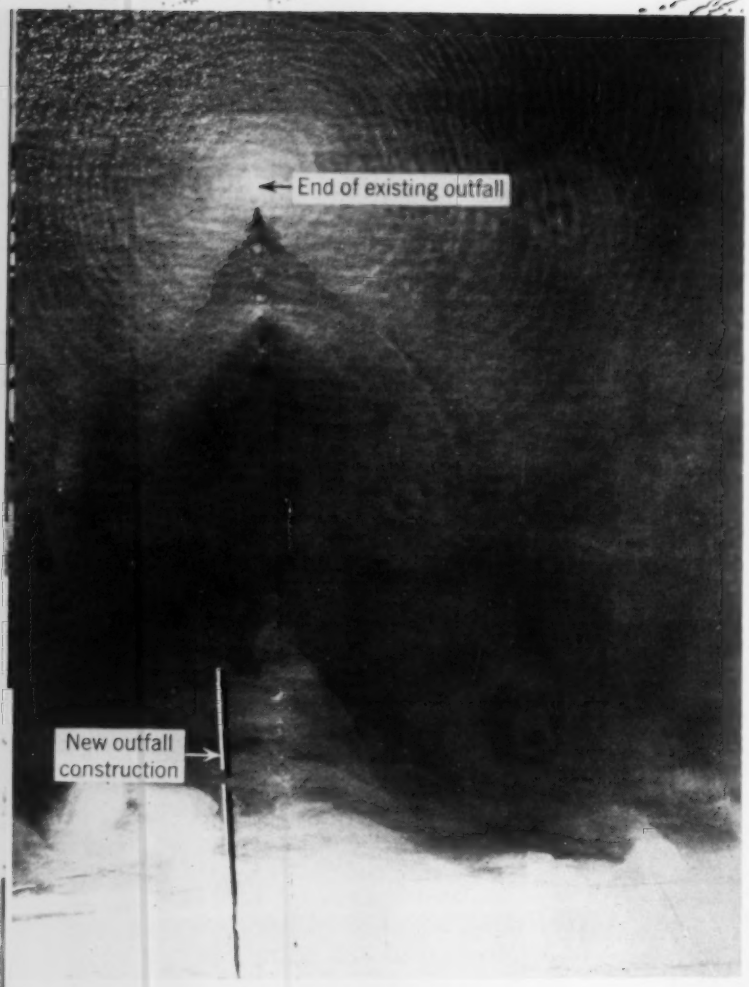


FIG. 1. PLAN OF Hyperion high-rate activated sludge plant shows means of routing storm-water overflow direct from primary settling tanks to submarine outfall. Average daily flow through plant is estimated to be 245,000,000 gal but modified design permits capacity flow of 650 cfs for short periods of time.



OLD LOS ANGELES OUTFALL is pictured from above as raw sewage totaling 185 mgd is discharged into waters of Santa Monica Bay. At upper left, sun's rays pick up grease film on water. Outfall leakage is also evident. Section of new outfall is seen in early construction stage.

mendations. The Board, made up of Samuel Greeley, Charles Gilman Hyde and Franklin Thomas, all Members ASCE, rendered a comprehensive and detailed report, recommending such immediate and future improvements as would meet the needs of several generations to come.

The consulting board's report, instead of bringing matters to a head, provided the opportunity for further differences of opinion. Suggestions and recommendations were offered by many who had heard of some type of plant far cheaper and more efficient than the type proposed by the engineers.

Seeing no hope of any agreement as to procedure, the State Board of Health in 1943 revoked the temporary permit granted in 1940 and shortly thereafter filed suit in the superior court against the City of Los Angeles and all outside cities and parties whose sewage reached Hyperion. The board also quarantined the beaches for a distance of five miles on each side of the disposal plant at Hyperion. This distance was later increased to six miles in each direction, or 12 miles in all.

Even this action did not bring about agreement on a program for preventing pollution. Some parties still believed that sewage effluent should not be discharged into the ocean at all but that a number of small treatment plants should be distributed throughout the city. Others felt that the consulting engineers had not been given sufficient time to make a proper study. Thereupon the City Engineer again recommended to the Board of Public Works that consulting engineers be employed. Both the board and the City Council concurred but with the understanding that the engineers to be employed meet with the approval of all the parties and that all the parties agree to abide by the engineers' report.

Engineers Submit Report

The firm of Metcalf & Eddy, Boston, Mass., was retained. Its report, dated April 25, 1944, included the following recommendations:

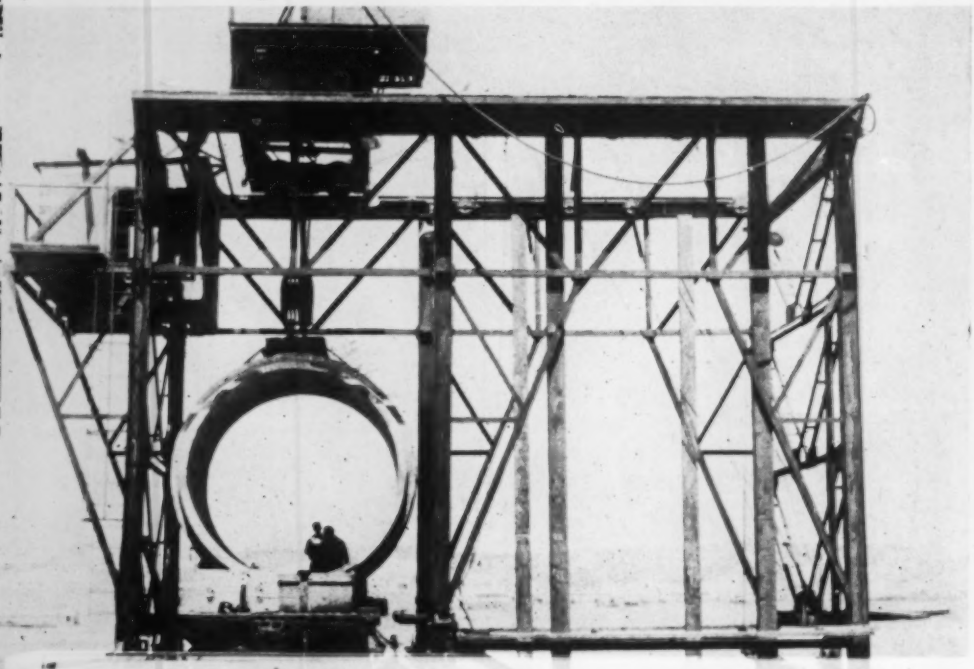
1. "That a new treatment plant of the high-rate activated sludge type be constructed back of the sand hills near Hyperion.

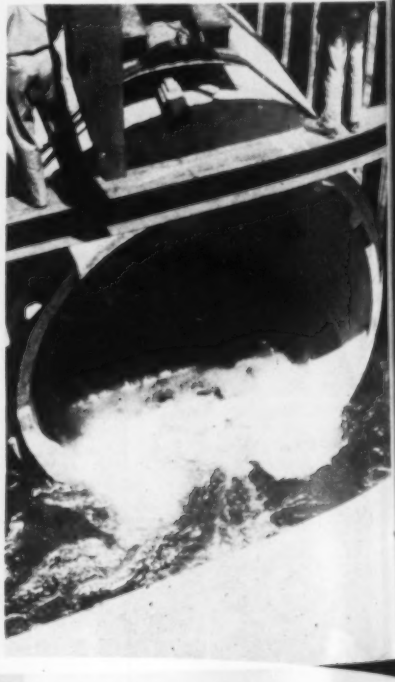
2. "That this plant be designed for an average capacity equivalent to the average dry-weather flow which the North and Central Outfall sewers can carry, or for about 380 cfs.

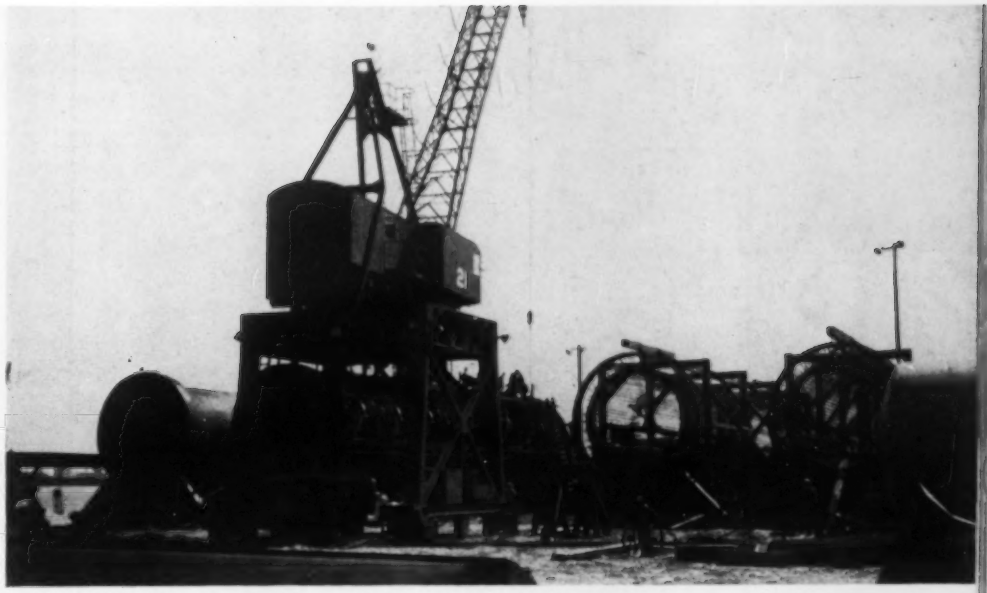
3. "That the effluent for the new plant be dispensed in the ocean through multiple outlets located about one mile offshore.

4. "That when the sewage flows to the plant near Hyperion reach 90 percent of the design capacity of the plant, a new trunk sewer be constructed to divert from the North Outfall sewer the flow in this sewer east of the divide between the Los Angeles River and Ballona Creek to a new treatment plant of the activated sludge type, or equivalent, to be lo-

GANTRY FRAME RIDING ON CONSTRUCTION TRESTLE and outer row of steel sheetpiling lifts 38-ton, 12-ft length of concrete pipe from flatcar (below, left) for placing in inshore section of submarine outfall. After pipe is set on pile-supported reinforced concrete foundation (below, right), space between walls of pipe and cofferdam is filled with tremied concrete covering pipe to depth of 18 in.







SHIPYARD CRANE PLACES STEEL FORM for casting 100-ft length of concrete pipe for offshore section of outfall. View of casting yard on Terminal Island shows reinforcement cages at right and finished pipe section at left.

ated in the industrial area along the river.

5. "That a suitable site for the future treatment plant along the Los Angeles River be acquired at once."

Los Angeles property owners living in the vicinity opposed the site because the sand dunes near Hyperion recommended by Metcalf & Eddy. Thereupon the City Council adopted all other recommendations of the report but instructed the Board of Public Works and the City Engineer to construct the plant on the original Hyperion site, which the consulting engineers agreed was a satisfactory alternate. Actual design, based on previous preliminary studies, started in January 1945. As the site lies within the area being reserved for a large park system, all units except the aeration and final settling tanks will be covered. Buildings are being designed to be architecturally pleasing and to give the effect of a high-grade industrial establishment in well-kept grounds.

The site is immediately adjacent to the coast, 800 ft back from high-tide line. The plant will cover an area 3,200×1,200 ft, comprising some 88 acres including grounds, all property that has been owned by the city for many years. To prepare the site, originally covered with high sand dunes, it is necessary to remove about 14 million cu yd of material.

Treatment plant design follows standard practice for the activated sludge process, modified to meet high-rate operation and utilizing the latest features in equipment and methods. No pumping is required as the normal operating water level at the inlet to the treatment plant is 32 ft above highest high water. Ample head is available for both necessary losses through the plant and for operation of the submarine outfall under all tidal conditions.

North and Central Outfalls Serve Plant

The plant is fed by two sewer lines, the North and Central Outfalls, with respective capacities of 450 and 90 cfs. These two outfalls drain an area of 450 sq miles and ultimately will serve a population of three million people and drain nearly 4,000 miles of laterals and interceptors. The North Outfall commences as a 15-in. pipe and for the last 10 miles of its length is a semi-eliptical section 10 ft 6 in. by 12 ft 3 in. With a total length of about 55 miles, it serves the cities of Burbank, Glendale, Culver City, Beverly Hills, Santa Monica and Vernon, and portions of Pasadena, South Pasadena, Alhambra and county areas, as well as densely populated sections of Los Angeles. The Central Outfall, $4\frac{1}{2}$ to 6 ft in diameter and ten miles long, was built 18 years before the North Outfall and originally carried the entire flow of Los Angeles. The terminals of both sewers are interconnected.

The combined dry-weather capacity peak flow of the two sewers amounts to 540 cfs and the average daily flow is estimated at 245 million gallons. However, during heavy storms the sewers may reach a combined flow of 650 cfs for comparatively short periods. Therefore the headworks and the primary settling tanks are being designed to accommodate 650 cfs while the rest of the plant has sufficient capacity to treat 540 cfs. After primary treatment, flow over 540 cfs may be bypassed to the ocean outfall.

A bypass of sufficient capacity to carry the flow of 650 cfs will extend entirely around the plant. The entrance, located just above the headworks building, will be controlled by electrically operated sluice gates. The lower end of the bypass will connect into the surge chamber at the entrance to the ocean outfall.

Although, in general, standard methods of design for this type of plant are being followed, as shown in the flow chart, Fig. 1, a few of the highlights are mentioned here.

To protect the bar-screen rakes from damage by heavy debris moving along the bottom, a stone basket will be placed in front of each screen. This device, which is provided with steel fingers set at such an angle that floating matter can pass over while heavy material is stopped, can be raised when necessary for cleaning.

At the bar screens, automatically operated rakes dump each load into a launder. From the launder, a stream of water carries floating material to a forebay ahead of two 36-in. comminutors which leisurely pulp the material, which is then returned to the main flow.

Before primary settling, the raw sewage will be aerated for 30 minutes, and the resulting foul air vented by a fan through a stack 200 ft high. Waste activated sludge and supernatant liquor from the digestion unit can be returned to the head of the preaeration channels.

All electrical energy, amounting to 6,400 kw, together with 126,000 cfm of air for aeration purposes, will be developed by nine 1,600-hp dual fuel-gas and oil engines comprising the power plant. Water jackets are to be cooled by the vapor-phase method, the waste heat being used to furnish low-pressure steam for heating the raw sludge before it enters the primary digestion tanks. Waste heat will also maintain the contents of the primary tanks at 100 deg F.

After mechanical drying to about 8 percent moisture content, digested sludge will pass to storage bins having a total capacity of 2,000 tons. These bins have "live" bottoms, made up of a series of spiral conveyors in parallel together with vertical walls, which preclude arching in the bins and permit trucks to be loaded at rates as high as one ton a minute through each of ten loading gates. The estimated 200 tons to be produced daily will be sold as a low-grade humus type of fertilizer, which is much in demand for the sandy soils of the vicinity.

To meet the demands of the court judgment and to permit the State Board of Health to open about $1\frac{1}{2}$ miles of beach on each end of the quarantined section, immediate construction of a temporary chlorination plant was required. Contracts were

FINISHED PIPE FOR OFFSHORE SECTION of outfall awaits launching from Terminal Island casting yard. Pipe at left has already been equipped with flotation tanks (later reconstructed as saddle tanks) but not with bulkheads. Note wrought-iron plates (painted white) on spigot ends facing truck, also radial slots to receive rubber gaskets.

let on May 29, 1946, to the Wallace Tiernan Corp. for equipment amounting to $89,644, and to the Hoagland Findley Engineering Co. for the building and installation, totaling $124,645. Less than a year later, on May 15, 1947, this plant went into 24-hour operation at full capacity, amounting to 20 tons of chlorine a day. When the primary section of the treatment plant is completed, the chlorination equipment will be moved to a permanent location in the new headworks building.

Sand Is Excavated Hydraulically

For the excavation of 14 million cu yd of sand from the plant site, a contract was let on May 29, 1946, to Peter Kiewit Sons' Co. and Construction Aggregates Corp. for $3,494,088. The coastal terrain for many miles on each side of the site is covered by wind-blown sand dunes extending several thousand feet inland from the shore and rising to elevations of 175 ft above the ocean. At the site this material is being removed down to a general elevation of 40 ft above sea level.

Although the hydraulic process used in removing the sand employs the standard type of monitor to wash down the faces, an unusual method is being followed for collecting the material and loading it into the pipelines. Sand broken down by the monitor streams flows to a pool in which an eductor, designed on the principle of an ejector, is installed. The entrance to the eductor is a box-shaped orifice leading into a venturi tube. This combination unit is incorporated in the pipeline, which is supplied with water under high pressure.

Sand and water entering the eductor are conveyed through several thousand feet of pipeline to a central surge pit where the flowing sand is distributed over the sand bottom through open valves in the pipelines leading in from the eductors. In the center of the surge pit is a steel mixing chamber equipped with adjustable air-controlled gates which act as movable weirs. Gates on each side of the chamber permit the operator to control the sand and water which enter. Additional water as needed for dilution is supplied by a clear salt-water line. Dials indicate the several pump and line pressures, and a watt meter shows the amount of power being used by the pumps. With this information before him, the operator governs the sand load being fed to the main 28-in. discharge line extending up the beach. The load is averaging 17 percent sand.

Sand from the discharge line, instead of being wasted, is being used to extend the beach line seaward for distances ranging from 600 to 800 ft over the entire 6 miles of shore northward from the El Segundo to the Santa Monica city boundaries. An elaborate park system is planned for this strip of coast at a later date.

The surge pit and mixing chamber, together with the 10,000-hp pumping plant, comprise the heart of the sand disposal system. Two suction and two booster pumps, each operated by a 2,500-hp electric motor, furnish the ocean water for the monitors and eductors and for moving the sand through the distribution lines. A second pumping plant $2^1/_2$ miles up the beach acts as a booster station on the main discharge line. The mixing process is known as the Sensibar method and is being used for the first time on a project of this magnitude.

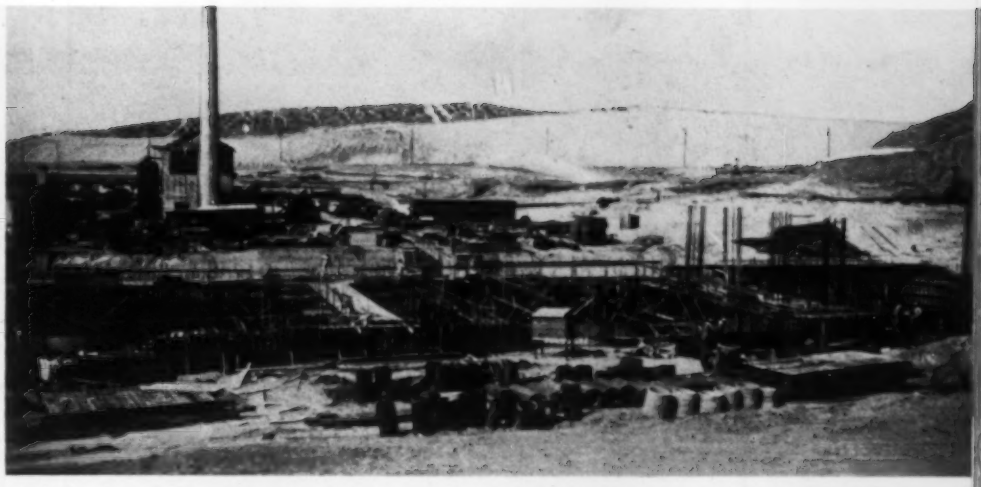
As a part of the sewage treatment project, a new submarine outfall will be completed in July to replace the existing outfall, built in 1924. The old structure, which has an interior diameter of 7 ft, is made up of reinforced concrete pipe 12 ft long, laid in a trench on the ocean floor and extending 1 mile offshore. Its inadequacy was due not only to its size but also to the fact that, because of faulty construction, it developed a series of bad leaks soon after construction.

The new outfall, a reinforced concrete tube with an inside diameter of 12 ft located about 800 ft south of the existing outfall, also extends a mile seaward. It is designed in two parts, known as the inshore and offshore sections. The inshore section, which extends through the surf, consists of reinforced concrete pipes in 12-ft lengths, each weighing 38 tons. This section rests on a steel-pile-supported foundation and is completely encased in concrete. The offshore section is made up of thirty-two 100-ft lengths of precast concrete pipe each weighing 455 tons. Joints are of special design, having a massive cradle-shaped bell with protruding lip to support and center the spigot end of the adjoining pipe. A heavy rubber gasket and reinforced concrete collar prevent leakage. Each cradle is supported on a concrete pier which in turn rests on steel piles.

Mile-Long Construction Trestle Carries Standard-Gage Track

Construction operations were conducted from a wooden pile trestle extending out the entire mile and equipped with standard-gage track for the operation of work trains, locomotive cranes, pile drivers and gantry frames. The work, to be completed in July 1948, required about two years, the contract having been let on May 27, 1946, to the Guy F. Atkinson Co. for $3,517,410.

The inshore section, through the breakers, was constructed by first driving two rows of steel sheetpiling 10 ft on each side of the center line, thus forming an open cofferdam. Next, the steel foundation piles were driven to a penetration of some 40 ft, after which the reinforced concrete foundation was poured through tremie pipes. Driving operations as well as the installation of the steel reinforcement cages and the laying of the pipe were conducted by means of a traveling gantry which rode rails laid on the trestle and on the outer wall of the cofferdam. The next step involved filling the space between the walls of the pipe and the cofferdam with tremied concrete, which also covers the top of the pipe to a depth



ESIGN AND CONSTRUCTION of sewage eatment plant are coordinated by letting ntracts for installation of units progres- ely as sand dunes are leveled to grade. foreground, headworks of new plant is der construction while old incinerator d stack in background still function to pose of screenings. On completion of imary section of new plant, old screening ant will be abandoned.

f 18 in. Finally, the steel sheetpiling rming the cofferdam was removed.

An entirely different method of onstruction was required for the off- hore section. The first step was the louring of the footings on which the radles rest. These footings have a 3×30-ft bearing face and extend 7 ft below the ocean floor. In this peration a steel form is lowered to he bottom, centered and sunk to osition by pumping out the sand. The twelve steel supporting piles are hen driven and the form is filled with oncrete through tremie pipes. Con- crete is mixed in a batching plant on hore and hauled to the location on lat cars. The 4-yd buckets contain- ng the mix are dumped into the remies by locomotive cranes.

Construction of the offshore section took place in the open ocean with no protection short of Catalina Island, 25 miles distant. The water, from 25 to 60 ft deep, is continuously agi- tated by heavy ground swells and cross currents. Nevertheless, the tremied concrete was poured to within a few hundredths of a foot of grade and the massive 100-ft lengths of pipe were placed to within $^1/_2$ in. of line. This accuracy was the result of experience gained the hard way as the violent and constant motion of the ocean, always a hazard, continually presented new problems for solution. Both sections of the outfall will be completed in July of this year.

On completion, the new outfall will be connected with the old screening plant, the old outfall abandoned, and the screened flow from the two sewer lines, then amounting to nearly 200 mgd, sent out to sea.

Early in the summer of 1948 construction will commence on the filter, drier and fertilizer unit, the digestion system, primary settling units, power and blower and shop units. Construction of the administration building housing the laboratories will also be started this summer. When these units are completed—probably late in 1949—they will be connected with the new outfall so that the primary treatment section of the plant can be placed in operation by 1950, thus greatly alleviating the polluted condition of the beaches.

Financing the Project

Financing the project has been a more difficult problem to solve than the technical features, and the opinions regarding it have been even more diverse. In 1938 and again in 1941, charter amendments to raise funds by special taxes for plant and relief-sewer purposes were voted down by the electorate. For twelve years the Bureau of Engineering has advocated a sewer service charge to raise funds but this method has never met with the general approval of the City Council. A citizens' committee appointed by Mayor Fletcher Bowron wrestled

(*Continued on page 80*)

Navy Pontoon Cubes Form Sturdy Structure on Manus Island

IN RAPIDLY DEPRECIATING U.S. Naval base on Manus Island in the Admiralty Group an emergency crossing over Lovengan River attests wartime ingenuity of Navy Seabees. Central span of structure is 12 cube pontoons long and four strings wide. Eight rows of 6 × 6-in. angles top and bottom provide flanges of girder while pontoons take care of shear. Bridge is still in use at huge base where jungle creepers are reported growing up telephone poles and out along cables so profusely that lines collapse. Untreated Douglas fir decking and beams are rapidly disintegrating from fungus rot. Creosoted wharf piles with penetration of about 1 in. are in good condition except at tops where rotting penetrates deep into unprotected heart. No speed limits are needed on roads made rough by erosion.

High-Speed Dual Parkway Relieves Washington-Baltimore Traffic Congestion

H. J. Spelman, M. ASCE
Division Engineer, Public Roads Administration, FWA, Arlington, Va.

TRAFFIC INTE CHANGE near D trict of Columbi Maryland line, whi presents complex d sign problem, planned for constru tion in three stage In first stage New Yo Avenue (across An costia River in l foreground) is e tended to connec with Washington Baltimore Parkwa (left arm of Y). I second stage, artist conception of whic is pictured here, Ne York Avenue is sp into two forks of Y with Annapolis Ex pressway formin right-hand fork. I possible third stage Anacostia Parkwa from south is to b extended acro Pennsylvania Rail road (in foreground to junction with Y.

TRIPLING OF TRAFFIC VOLUME on the old Washington-Baltimore highway in less than a decade emphasized the necessity for constructing a modern parkway over the 30-mile distance between these two large population centers. On receipt, in 1942, of two million dollars of FWA funds, detailed preliminary work on the project was initiated. The right-of-way for 18 miles between Washington and Jessup has been acquired, and 6 miles have been graded. Plans have been completed for most of the structures and are nearing completion for the remainder of the grading. Modern, dual-highway design with north and south roadways separated by a median strip of varying width will provide for a speed of 75 mph. Through an agreement with the Maryland Roads Commission, the Public Roads Administration is constructing the $18^{3}/_{4}$-mile section of the parkway nearest Washington, D.C., where federal interest is paramount—the section described herein—and the Maryland Commission will complete the remaining $11^{1}/_{4}$ miles on the north end of the route.

PRELIMINARY STUDIES of a parkway between Washington and Baltimore were made by the National Capital Park and Planning Commission as early as 1933. Further interest in the project was developed by the regional planning report of the "Baltimore–Washington–Annapolis Area," issued by the Maryland State Planning Commission in November 1937.

Between Washington and Baltimore there are four federal reservations: Greenbelt Housing Development, Beltsville Agricultural Research Station, Fort Meade, and the District of Columbia Home for Feeble Minded Children, having areas of $4^{1}/_{2}$, 18, 21 and $1^{1}/_{2}$ square miles, respectively. To determine the probable location of a parkway through or adjacent to these federal areas, a reconnaissance survey was made by the Bureau of Public Roads in November 1938. With three railroads and one principal highway already connecting the two cities, the best locations were already taken. The 1938 reconnaissance, however, developed a satisfactory line from the city limits of Washington to a point well north of Fort Meade, the most northerly of the four federal reservations (Fig. 1).

AVERAGE DAILY TRAFFIC near the Washington city line on the old Washington–Baltimore highway (Route U.S. 1), which is paved to a width of 40 ft, was 13,000 vehicles in 1930, 28,000 in 1940, and 29,300 in 1947. Counts at the Baltimore city line in the same years showed 7,000, 17,900, and 19,750, respectively. At Bladensburg Road, at the District of Columbia line, traffic counts were 8,700 vehicles in 1932, 26,600 in 1940, and 27,300 in 1947.

Reconnaissance was made of three possible lines in the Beltsville vicinity to determine whether it was possible to go around rather than through the Agricultural Research Station reservation. The line finally adopted crossed the reservation at its narrowest point, and skirted the future western boundary of Fort Meade, and was agreed to by the Agriculture and War Departments in January 1940. Agreement was then reached that the Public Roads Administration would make the preliminary surveys from the District of Columbia line to the northern limits of Fort Meade because of the large federal interest in this part of the route, and that the Maryland Roads Commission would make surveys from this point to Baltimore.

In September 1942, the President ordered $2,000,000 from Public Works funds allotted to the Public Roads Administration for the proposed parkway from the District of Columbia line to Jessup Road, near the northern limit of Fort Meade, a distance of approximately $18^{3}/_{4}$ miles, to be used to acquire right-of-way over private lands, and to construct two sections of the proposed parkway.

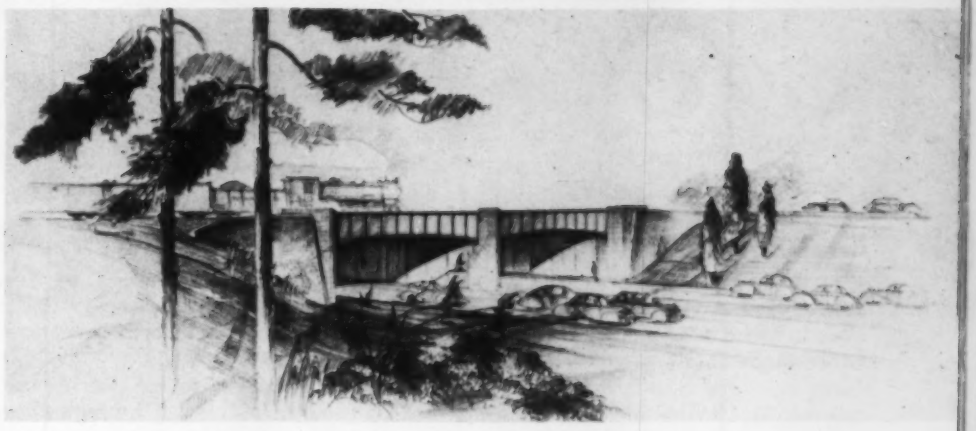
Early in 1943 further study of the location between the District of Columbia and Greenbelt was undertaken. Four preliminary lines on this 7-mile section were developed, and approximate estimates of cost

were made for each. An experienced appraiser in private practice was engaged to estimate right-of-way costs on each. All lines were projected on wide topographic strips. Profiles were established and approximate estimates of grading and other quantities were made. When these estimates were completed in the fall of 1944, it was decided to adopt the most easterly line, which followed the 1938 reconnaissance except at two points where new real estate developments made a new location necessary.

In the selection of the location, no effort was made to obtain tangent alignment. The free use of curves made it possible to fit the topography better and to reduce the property damages in the right-of-way takings. Usually each roadway was located separately, and at varying distances from the other. Where the roadways are together, the median strip is at least 15 ft wide. At some points the roadways are separated as widely as 400 ft, often by woods. No effort was made to keep the profile grade of each roadway the same.

Except for right-of-way acquisition, the development of a location and plans has followed generally the established procedure used on Eastern parkway projects, under which the National Park Service does landscape and architectural work.

The reconnaissance line as finally determined was marked on USGS maps, and "flagged" in the field. A random transit line was run following the flagged line; levels were taken and benches established. Contours were taken by hand level or plane table, and a contour strip was plotted approximately 400 ft wide on a scale of 100 ft to the inch. At crossings of paved roads the contour strip was extended to a width of 1,000 ft or more to develop information for the interchange design. All buildings, property lines and structures were plotted on these maps.



TWO-SPAN STEEL GIRDER on stone-faced abutments is to carry Baltimore & Ohio Railroad over parkway at Annapolis Junction. Most overpasses (usually stone faced) consist of two spans, but underpasses (concrete faced) in some instances are composed of separate structures for northbound and southbound roadways.

Design of Roadways

Design standards established by the Public Roads Administration in November 1943 followed those for rural sections of interregional highways in the report "Interregional Highways," of January 5, 1944. The road is designed for a 75-mile speed, with a maximum curvature of 2 deg 30 min and superelevation at all curves above 0 deg 15 min. All curves above 1 deg are spiraled. The maximum grade in this rolling country is 3 percent, except at one point where 4 percent is approached. Traffic lanes are 12 ft wide. Three lanes are graded in each direction but initially only two lanes will be paved. Shoulders are 10 ft wide to the point where rounding begins. The median strip is not less than 15 ft wide. Side slopes are 1 on 4 to heights of 10 ft, and the steepest slopes are 1 on 2.

On the contour maps a spline projection of the center line was made.

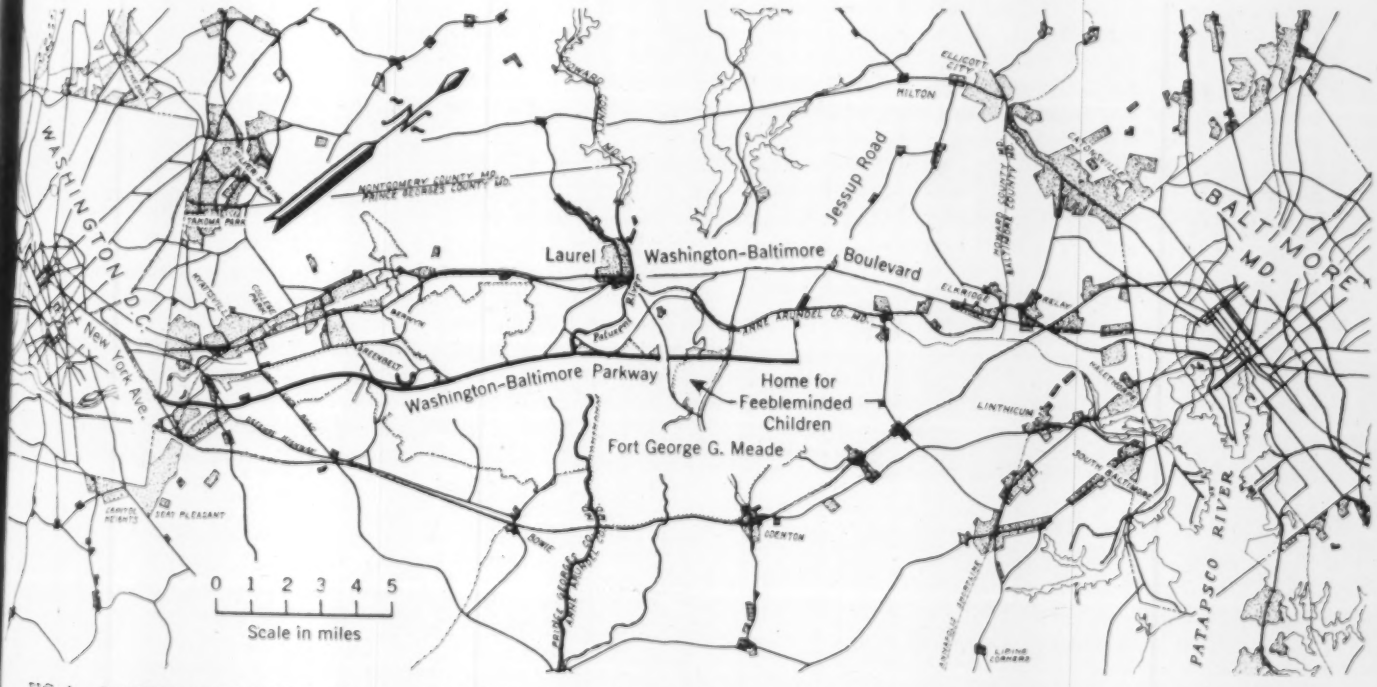


FIG. 1. SOUTHERLY SECTION of high-speed Washington–Baltimore Parkway, constructed by Bureau of Public Roads, extends distance of 18¾ miles, from New York Avenue in Washington, D.C., to Jessup Road at northern boundary of Fort Meade reservation. Parkway for remaining distance to Baltimore is under jurisdiction of Maryland Roads Commission.

SEPARATED NORTH- AND SOUTH-BOUND ROADWAYS are located at distances varying from 15 ft to 400 ft apart. Large pans and bulldozers (left) bring section of parkway to grade for paving. View of finished grade (right) shows roadways at different levels. No effort is made to obtain same profile grade for two roadways. Grading work is let in separate sections of sizes and lengths attractive to bidders. Paving contracts, which include provision for slope top-soiling and seeding, are to be let after grading and structures are completed.

A separate projection was made of both the north- and south-bound center lines where topography permitted. Profiles were plotted from the topography, trial grade lines were laid and a final center line and grade were ultimately established.

As the center-line projection progressed, preliminary studies of interchanges at grade separation structures were made in sufficient detail to enable the right-of-way lines to be established. When the preliminary projections were complete, a contract was let for borings at the sites of bridges and structures, and in the larger cuts of the roadways.

Right-of-Way Maps Prepared

After preliminary projections were complete, right-of-way limits were established. A separate map on a scale of 600 ft to the inch was made showing the entire tract of each owner and all public and private roads. In establishing the right-of-way, extra widths were taken as needed to avoid excessive severance damage. In no case was a tract or part of a tract left without access to some road. In a few places it was necessary to provide short border roads.

The right-of-way maps were drawn to scales of 600 ft and 100 ft to the inch. On each the tract number and owner's name are shown. On the larger scale maps the metes and bounds of each tract are given. The plans include a list of owners, giving tract number, acres owned and acres to be obtained from each. The maps on a scale of 100 ft to the inch show the preliminary transit line but not the new center line.

Right-of-way maps when completed were furnished to two appraisers for an appraisal of cost on each tract. Right-of-way maps, descriptions of each tract, and an approximate estimate of value of each tract were then filed with the Attorney General of the United States for condemnation. After the appraisals were completed, an agent was sent out by the Public Roads Administration to obtain options where owners were willing to accept prices within the approximate range of the appraisals. Where reasonable option prices could not be obtained, final settlement was left to the Justice Department.

Where federal land was needed, maps showing the area required on a convenient scale were furnished the appropriate agency with a request for transfer of the land to the Public Roads Administration.

When the final projected center line was established at a structure site, a situation plan was sent to the Division Bridge office, where an outline sketch of the proposed structure was prepared and sent to the architect, to the Maryland State Roads Commission for a state road or to the county engineer for a county road, and to the Maryland National Capital Park and Planning Commission. After the over-all dimensions for the local roads were approved by the local agencies, the architect prepared a preliminary architectural plan, submitted it to the Fine Arts Commission, and upon their approval furnished it to the engineer.

After the final projected center line is established for any section, grading plans for that section are prepared from the projection. These include a plan and profile in general accordance with accepted highway practice. The 5-ft contour lines and the record of soil borings are shown. The right-of-way lines and the preliminary transit lines are shown, as well as the center line and profile of each roadway. At this stage, careful study is given to each interchange, and that part of the interchange work which is considered desirable is included in the grading.

The typical cross section for grading requires that approximately 2 ft of selected soil of a granular nature be placed on all fills and in all cuts where the natural soil does not consist of such material. Grading of the roadway is planned so that a pavement can be placed later, on approximately 12 in. of granular material, with shoulders of the same material. Stripping and storing of topsoil is required in the grading contracts. Replacement is to be made in a later operation when the paving is completed.

No Parkway Crossings at Grade

There are no crossings of the parkway at grade and entrance to and exit from it are only at public road interchanges. Pedestrains are restricted from crossing the roadway at grade. On the $18\frac{3}{4}$ miles of the project, nine interchanges are required at public road crossings, not including the interchange at the District of Columbia line. Of these, four provide access to federal reservations and four to the suburban communities of Bladensburg, Riverdale and Cheverly. The ninth provides access in a rural area to the state road running from Laurel to Bowie, site of the well-known Maryland racetrack.

The designs of these interchanges differ according to the probable traffic volume to and from the park-

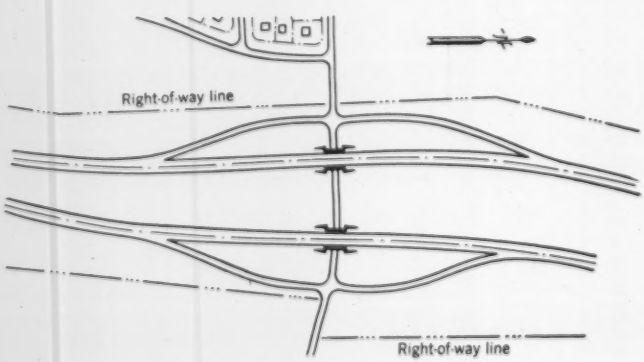


FIG. 2. INTERCHANGE AT RIVERDALE ROAD consists of simple four-way entrance and exit. All grade-separation designs on parkway are based on estimates of traffic volume in each direction. Parkway has no crossings at grade.

SELECT BORROW OF GRANULAR NATURE is applied to fill sections and cuts where natural soil does not meet specifications. Material dumped on grade is spread by bulldozers and compacted by sheepsfoot rollers to meet standard requirements. Compaction is controlled by field tests. Contractors use both rubber-tired and crawler-type equipment for grading operations.

way. Estimates of probable traffic volume in each direction of movement were used to guide the designer. Tentative layouts have been made for all interchanges, varying from full cloverleafs to less elaborate connections. The design for the one at Riverdale Road is shown in Fig. 2. This simple four-way entrance and exit seems well adapted to a local road crossing which carried only 700 vehicles a day in 1944. The plan has the advantage of simplicity and low cost. The entrance and exit roads also serve as places for buses to stop as a service to the adjacent housing development. Traffic into the crossroad will probably need to be controlled by "stop" signs.

Buses will be encouraged to use the parkway but will not be permitted to make stops on it. The type of interchange developed for Riverdale Road serves the purpose of a bus stop very well, but such a plan can be used only where the crossroad is of low traffic density. It seems probable that at roads of high traffic density the adjacent population will be well served by buses that leave the parkway to give local service.

A complicated problem in design is presented near the District line where the parkway joins the proposed Washington–Annapolis expressway, which will leave Washington on New York Avenue extended. In the future a parkway extension may be built from this point down the Anacostia Valley. This future traffic hub is in a flat area often overflowed by the Anacostia River near its crossing with the Pennsylvania Railroad. An exhaustive study of the problem was made by the Urban Roads Division of the Public Roads Administration under the direction of Joseph Barnett, M. ASCE, and a design was presented which provides a solution for each of the successive stages of route development. (See accompanying illustration showing artist's conception of the second stage of construction.)

Highway Crossings and Other Bridge Structures

Besides the nine highway-crossing structures which provide access to the parkway, there are two crossings of branch-line railroads, two river crossings, the Patuxent and Little Patuxent, and five structures at local roads. Several local roads have been relocated to avoid structures.

Minimum clearances for the structures conform to the standards recommended in the Interregional Report. Underpasses have at least $4\frac{1}{2}$ ft of clearance beyond the pavement edge on the left side of each roadway, and normal shoulder width on the right side. The central island is 15 ft wide. Vertical clearance is at least 14 ft at the edge of pavements and, because of the arch structure, is more than 16 ft in the middle of each roadway. Short-span bridges have horizontal clearances as given above.

The Little Patuxent crossing consists of two structures, each a reinforced concrete continuous-girder design of five spans, having an over-all distance between abutments of 350 ft. The crossing over Riverdale Road consists of two concrete rigid-frame, single-span structures. Clearance between abutments is 52 ft. Good Luck Road is carried over the parkway on a double-span, stone-faced, rigid-frame, concrete structure providing a roadway width of 48 ft between parapets.

Acquisition of Right-of-Way

Right-of-way obtained for the parkway varies from a minimum width of 400 ft up to a maximum of 1,200 ft at some of the important interchanges. Condemnation proceedings were initiated for all except one of the 149 tracts required from private owners. A settlement has been reached in all except three cases. The cost of the necessary rights-of-way from private owners will be about $415,000, to which must be added $27,000 for appraisals and title searches, making a total cost of $442,000.

The total number of acres required from private owners is 832. Improvements taken include four houses ranging in appraised value from $6,000 to $9,200, six from $4,000 to $5,500, nine from $2,000 to $4,000, six from $1,000 to $2,000, and ten shanties having a value of less than $1,000. The only commercial buildings taken were two corrugated iron hangars at a privately owned commercial airfield. Nearly all the property damage occurs in the first 6 miles out of Washington as might be expected.

The length of parkway over which privately owned land was required is 10.3 miles. The approximate cost of right-of-way per mile is $43,000, and the approximate cost per acre including improvements is $530. The acreage taken includes unimproved woodland, valuable truck farms, suburban lots, improved homes, potential industrial sites, and possible country home sites.

Contracts Let for Grading and Structures

Grading work has been let in separate sections of sizes and lengths attractive to bidders. Structures will be let either singly or in small groups. Four grading contracts have now been completed covering the grading of 5.9 miles out of the $18\frac{3}{4}$ miles of the project. Specifications for these contracts were Public Roads F.P.41 of 1941, revised as to the concrete items so as to require a designed and controlled mix in accordance with recently adopted Public Roads practice. Wage rates were set by the Labor Department for these jobs in advance of advertisement. For the two jobs nearest Baltimore, the unskilled labor rate was 80 cents per hour, other rates varying from 75 cents for light-truck drivers to $1.80 per hour for power-shovel operators. On the Washington end of the project similar rates were 90 cents, 80 cents and $2.00 per hour.

These contracts were let between June 23 and August 23, 1945. All are completed. The contractors and the amount of each contract were:

Dutcher Construction Co., Queenstown, Md.	$282,100
Virginia Paving Co., Arlington, Va.	229,415
Hendrickson Bros., Valley Stream, N.Y.	351,225
R. B. Jaggard Co., Westmont, N.J.	331,633

The total quantities estimated for the principal items on the four contracts were:

Excavation, including topsoil	2,058,000 cu yd
Overhaul	19,550,000 station-yd
Concrete	6,980 cu yd
Pipe culverts	23,300 lin ft
Underdrains	23,400 lin ft

Pipe culverts varied in diameter from 18 to 48 in. For larger structures plain concrete semicircular arches of 6- and 9-ft spans were used. One double 10×12-ft reinforced concrete box was included in the one contract let after wartime controls of steel were eliminated. The arch-type design was originally used to eliminate steel. All contractors used concrete from nearby commercial plants delivered at the site in large transit-mix trucks.

The prices for unclassified excavation (rock did not occur) ranged from 27½ cents to 31 cents per cu yd. Concrete ranged from $20 to $36.50 per cu yd, the higher price accompanying the lowest price for excavation. The price for overhaul varied from ¼ cent to ½ cent per station-yard, again the higher price accompanying the low excavation price. Concrete pipe of 18-in. diameter was $2.50 per lin ft on three jobs and $3.00 on the job with the low excavation price.

The Dutcher Construction Co., having 500,000 yd to move, used twenty 12-yd scrapers. The Virginia Paving Co. for 285,000 yd used eight 10-yd scrapers. Hendrickson Bros. for 715,000 yd used twelve 12-yd and eight 30-yd scrapers. The R. B. Jaggard Co. for 550,000 yd used eight 12-yd scrapers.

General plans for the work were approved by the National Capital Park and Planning Commission and plans for structures were approved by the National Fine Arts Commission. Plans for all work are sent to the State Roads Commission, the county engineer, and the Maryland National Capital Park and Planning Commission for approval of local road changes. All plans are also approved by the National Park Service.

The connection with the City of Washington required the approval of the District of Columbia Highway Department, the Maryland Roads Commission, the National Capital Park and Planning Commission and the Maryland National Capital Park and Planning Commission.

The project is under the writer's direction as Division Engineer. The 1938 reconnaissance studies were made by Senior Highway Engineer E. G. Middleton, M. ASCE. Surveys, road plans and construction were under the direction of Senior Highway Engineer F. E. Winter, M. ASCE, until January 1, 1946, and since that date under Senior Highway Engineer E. L. Tarwater. Bridge design has been under the direction of Senior Highway Bridge Engineer C. D. Geisler. The design for the interchange with the Annapolis Expressway near the Washington city line was made by the Urban Roads Division of the Public Roads Administration, of which Joseph Barnett, M. ASCE, is chief. All plans have been reviewed by that division. Harry Thompson of the National Park Service directed landscape and architectural work. B. L. Breeze was resident landscape architect. W. M. Hausmann was architect for the bridges.

First Major Unit in Missouri Basin Plan Begins Operation

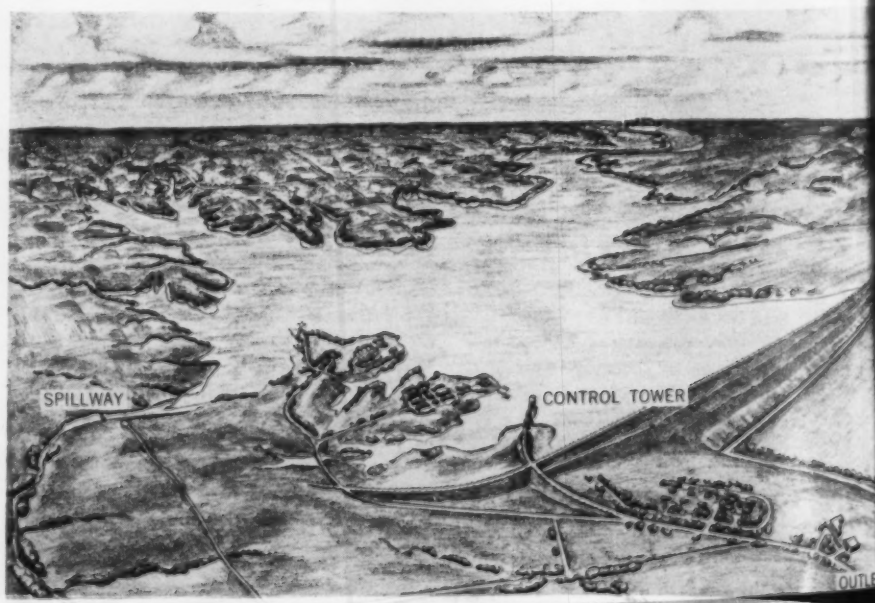
KANOPOLIS DAM on the Smoky Hill River in Kansas—the first major flood control dam and reservoir unit of the broad Pick-Sloan Missouri Basin Plan—became a reality recently at dedication ceremonies witnessed at the site by 35,000 people.

The 3-mile-long compacted earth dam rising 131 ft above the river bed will create a lake 12 miles long, covering 3,500 acres, at conservation pool level, with the maximum storage capacity during high river stages of 400,000 acre-ft. The reservoir, now being filled, has inundated about 1,000 acres.

Although the reservoir capacity is adequate to impound the largest flood which might reasonably be expected—greatly exceeding any flood of actual record—a fixed-crest spillway 500 ft wide at the control section has been provided for passing extreme flood waters without endangering the dam. Construction of the spillway required excavation of 2,700,000 cu yd of earth, placement of 19,000 cu yd of concrete and 300 cu yd of stone riprap.

The water from Kanopolis Dam will be released as needed to insure domestic water supply and avoid stream pollution in the river below the dam. Preliminary studies are being made of the possibility of taking water from the reservoir for irrigation of land downstream.

First authorized by Congress in the Flood Control Act of 1938, the Kanopolis project was designed primarily for flood control on the Smoky Hill and Kanas Rivers. Started in 1940, work on the dam was halted in 1942 by the war. The project, resumed in 1946 as part of the Pick-Sloan Plan under the 1944 Flood Control Act is one of 105 reservoirs included in the basin program for flood control, irrigation of nearly five million acres, navigation, production ultimately of nearly ten billion kwhr of electricity annually and other public benefits.



RECENTLY COMPLETED Kanopolis Dam on Smoky Hill River in Kansas is 14,668,000-cu yd earthfill structure in Pick-Sloan Missouri Basin improvement program. Dam. 730 ft wide at base, 25 ft wide at crest and about 3 miles long, is faced with 173,400 cu yd of stone. Water from reservoir flows through concrete tunnel 14 ft in diameter and 2,443 ft long. Controlled flow through tunnel is regulated by two gates located at upstream end of conduit.

New Construction Activities Compared on 1939 Price Basis

NEW CONSTRUCTION ACTIVITY in terms of current prices and in terms of 1939 prices for the years 1915–1947 inclusive is given in the Department of Commerce report, "Construction and Construction Materials—Statistical Supplement," May 1948. Measurement of new construction activity in 1939 prices is a satisfactory means of indicating actual changes in the physical volume of construction. The procedure used in Table I (Table 10 of the supplement) is to deflate each class of construction by an appropriate construction cost index. This procedure was made necessary by the almost complete lack of direct comparable measures of physical volume. Since at best most cost indexes give only approximate changes in costs, the estimates in 1939 prices provide but crude indicators of physical change.

The composite cost indexes for total new construction in Table I are implicit indexes computed by dividing the totals in current prices by those in 1939 prices. Since the totals in 1939 prices were obtained by adding the estimates for the separately deflated classes of construction, the composite cost indexes are the equivalent of variably weighted indexes.

Cost indexes selected as appropriate deflators for the different types of construction were chosen from the large number of indexes now compiled by private and government agencies. In those instances where more than one index was relevant, selection was primarily a matter of judgment conditioned by such factors as the labor, material and overhead components included, the geographic coverage, etc. The cost indexes used are listed on pages 39 and 40 of the Statistical Supplement.

Estimates of construction activity cover the erection of structures of all kinds, including buildings, bridges, dams, and similar projects. They also cover other construction, such as highways, airfields, railroad lines, electric power lines, telephone lines, pipelines, fences, windmills, reservoirs, water and sewer systems, docks, flood walls, irrigation systems and canals. The estimates do not include oil well drilling, which is separately reported in Section IV of the Supplement. They do not incldue any mining operations, but do include the construction of mine buildings above ground. Also excluded is farm work that is an integral part of farm operations, such as terracing and construction of stock ponds and individual farm irrigation and drainage ditches.

The figures include the value of equipment which is an integral part of a structure, such as heating, plumbing, lighting equipment, and elevators. They do not include production machinery or furnishings, such as manufacturing machinery, power-generating equipment, telephone switchboards and hospital beds.

TABLE 1. TOTAL NEW CONSTRUCTION ACTIVITY IN CURRENT AND 1939 PRICES, AND COMPOSITE COST INDEX, 1915–1947
(Dollar Figures in Millions)

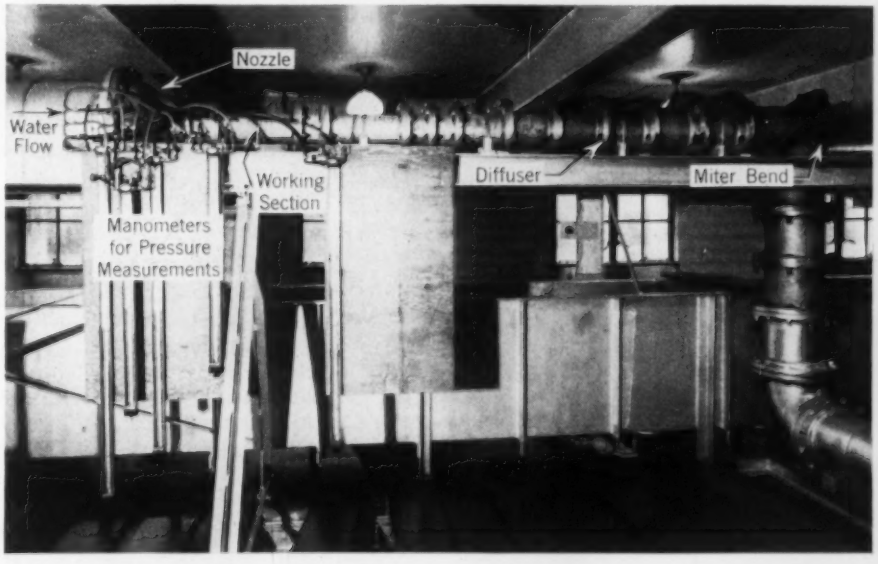
Year	Total New Construction Activity		Composite Cost Index	Year	Total New Construction Activity		Composite Cost Index
	Current prices	1939 prices	(1939 = 100)		Current prices	1939 prices	(1939 = 100)
1915	2,932	4,984	58.8	1932	3,290	4,057	81.1
1916	3,453	5,305	65.1	1933	2,376	2,728	87.1
1917	4,138	5,209	79.4	1934	2,805	2,971	94.4
1918	4,714	5,109	92.3	1935	3,230	3,558	90.8
1919	5,736	5,413	106.0	1936	4,836	5,210	92.8
1920	6,117	4,570	133.9	1937	5,487	5,438	100.9
1921	5,531	5,078	108.9	1938	5,186	5,203	99.7
1922	7,017	7,183	97.7	1939	6,307	6,307	100.0
1923	8,567	8,002	107.1	1940	7,042	6,858	102.7
1924	9,548	8,993	106.2	1941	10,490	9,339	112.3
1925	10,512	10,027	104.8	1942	13,412	10,390	129.1
1926	11,119	10,569	105.2	1943	7,784	5,737	135.7
1927	11,067	10,604	104.4	1944	4,136	3,103	133.3
1928	10,780	10,314	104.5	1945	4,808	3,500	137.4
1929	9,873	9,257	106.7	1946	10,458	6,553	159.6
1930	8,042	7,857	102.4	1947	13,977	7,344	190.3
1931	5,967	6,363	93.8				

Special Feature Report

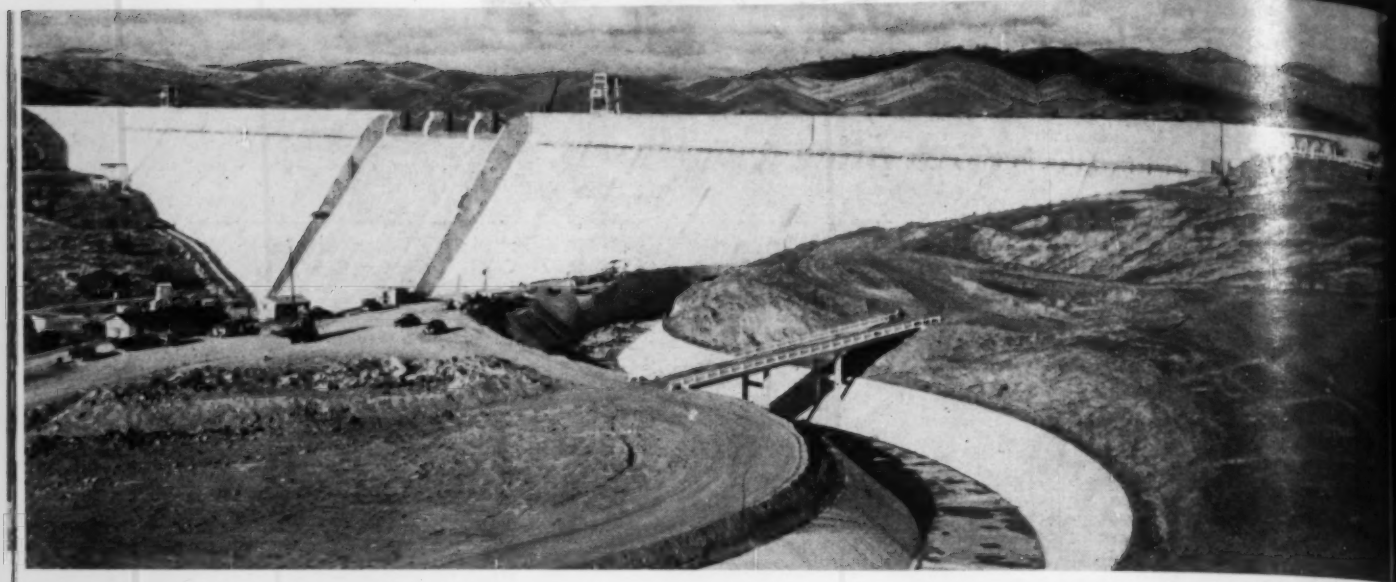
In addition to the "Statistical Supplement," the Department of Commerce recently released a "Spe-

(*Continued on page 82*)

Experimental Model Presages Country's Largest Water Tunnel



MODEL FOR LARGEST WATER TUNNEL in country, to be used by Ordnance Research Laboratory at Pennsylvania State College, is pictured here in experimental stage. Prototype will be used in research on design, modification and improvement of propelled underwater devices in use similar to that of wind tunnel in testing airborne devices. Tunnel, 97 ft long and 31 ft high with working section of 48-in. inside diameter and 14-ft length, will provide smooth, streamlined flow of water in which models can be tested with maximum velocity greater than 60 fps. At this velocity, more than 750 cfs will pass through working section or more than 1,000,000 gal of water every three minutes. Water will be circulated by 95-in.-dia, four-blade, variable-pitch impeller, driven by 1,750-hp wound-rotor induction motor.



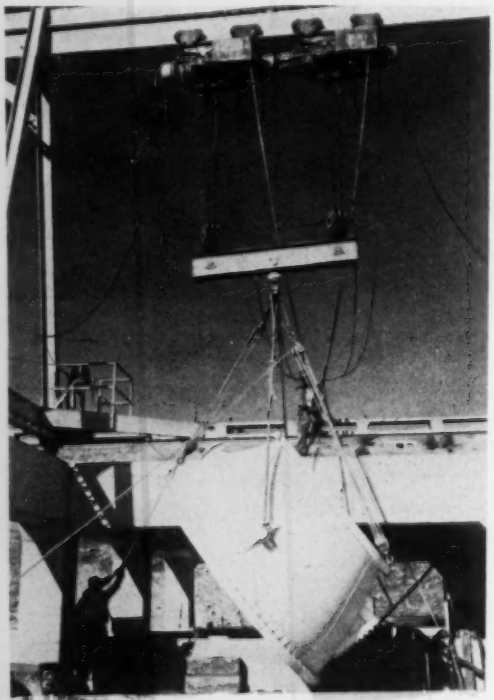
COMPLETED SPILLWAY GATES and part of Friant-Kern Canal are seen in recent view of Friant Dam in Central Valley Project, Calif. Erection trestle has just been removed. Reservoir and canal will provide main water supply for southern part of San Joaquin Valley. Start of irrigation delivery is worked out on control schedule by integration with completion of dam control works and finishing of canals.

Bureau of Reclamation Procedures Control All Phases of Heavy Construction Program

ALFRED R. GOLZÉ, M. ASCE

Director, Office of Programs and Finance, Bureau of Reclamation, Washington, D.C.

AS THE FIRST STEP in reorganizing the Bureau of Reclamation in 1943, seven regional offices were established to administer, close to the site, the Bureau's widespread construction program. A second step in the reorganization comprised the establishment of the Office of Progress Control in Washington for programming the Bureau's work. The Control Schedule and Annual Program Schedule introduced by this agency in 1946 now form the official basis of control of all Bureau of Reclamation work. These and other steps taken by the Bureau to develop procedures and policies for proper coordination of all phases of its comprehensive construction program are explained in this paper.



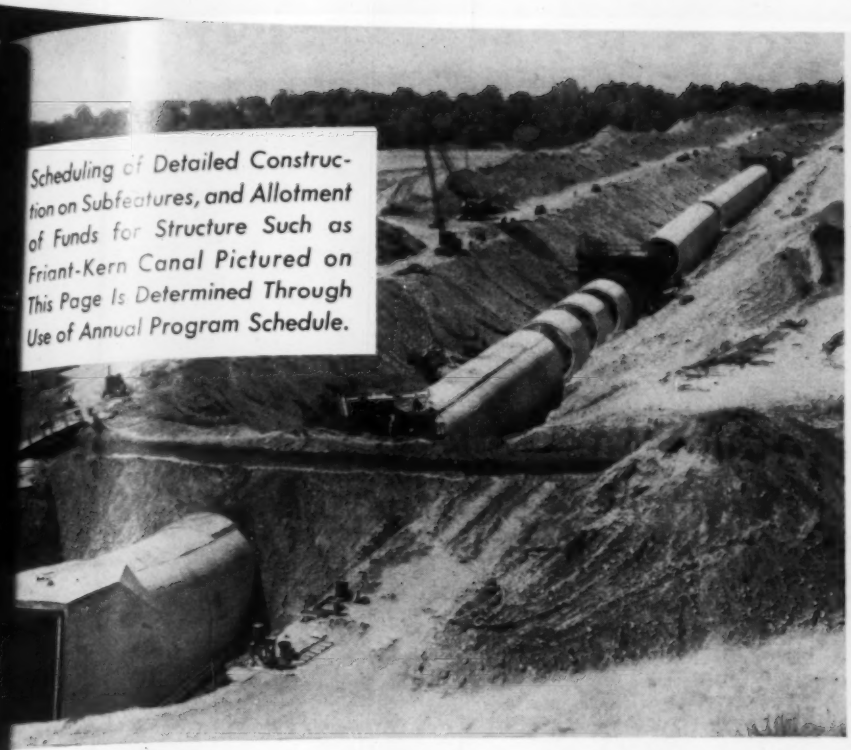
NEEDLE VALVE used at Friant Dam during war is dismantled, replaced by permanent valve, and returned to Hoover Dam from which it was borrowed. Timing and financing of such operations are first developed on Control Schedule and shown in detail on Annual Program Schedule.

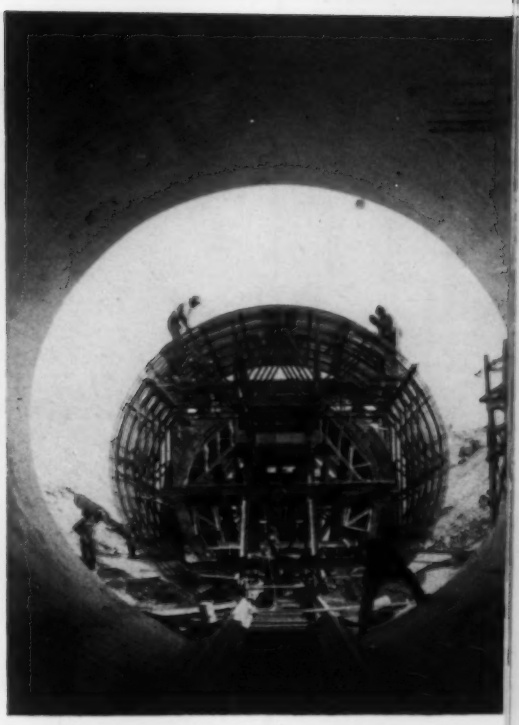
PRIOR TO 1930 the Bureau of Reclamation was not considered a major agency of the federal government or an outstanding construction enterprise of the United States although it had a good record for the construction of notable dams such as the Arrowrock and American Falls in Idaho. In 1930 the Bureau undertook construction of the first major multiple-purpose project in the Western United States—Hoover Dam and power plant on the Lower Colorado River, between Arizona and Nevada. This massive structure, constructed in an isolated canyon under wearying conditions of intense summer heat, led the Bureau to develop construction procedures and overcome engineering problems not previously attempted in the history of civilization. An annual power production of more than a billion kilowatt-hours for a period of eleven years and full control of the Lower Colorado River attest the excellence of the work done.

Before Hoover Dam was completed, more large-scale projects were being planned under the Public Works Administration program, as part of the nation's efforts to recover from the depression. The Columbia Basin project in Washington, with its mammoth Grand Coulee Dam, and the Central Valley project in California, to shift water and power 500 miles from north to south, were parts of this effort assigned to the Bureau of Reclamation. They were followed by others—the Colorado-Big Thompson project in Colorado, with its 13-mile tunnel under the Rockies, and later the Missouri Basin project, spread over a good part of the seven Northern Plains States, conceived during the war and now moving ahead rapidly in the postwar era.

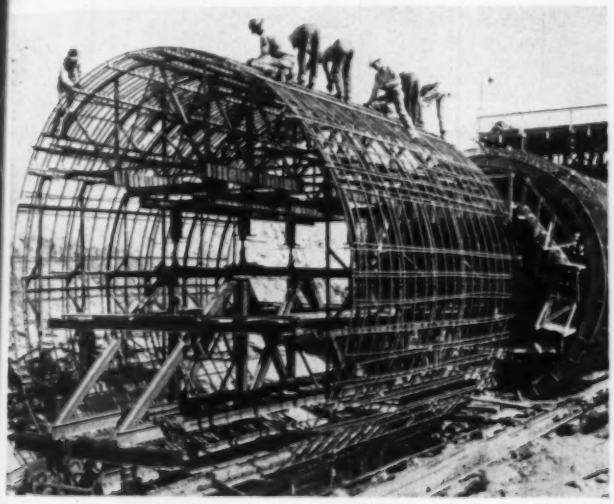
Most of the big projects authorized before the war remained in a partly completed and semi-dormant state while the Bureau's efforts and re-

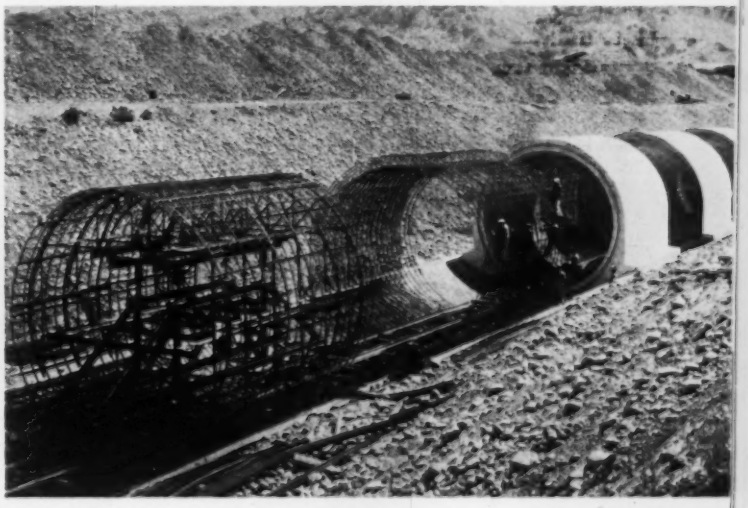
Scheduling of Detailed Construction on Subfeatures, and Allotment of Funds for Structure Such as Friant-Kern Canal Pictured on This Page Is Determined Through Use of Annual Program Schedule.





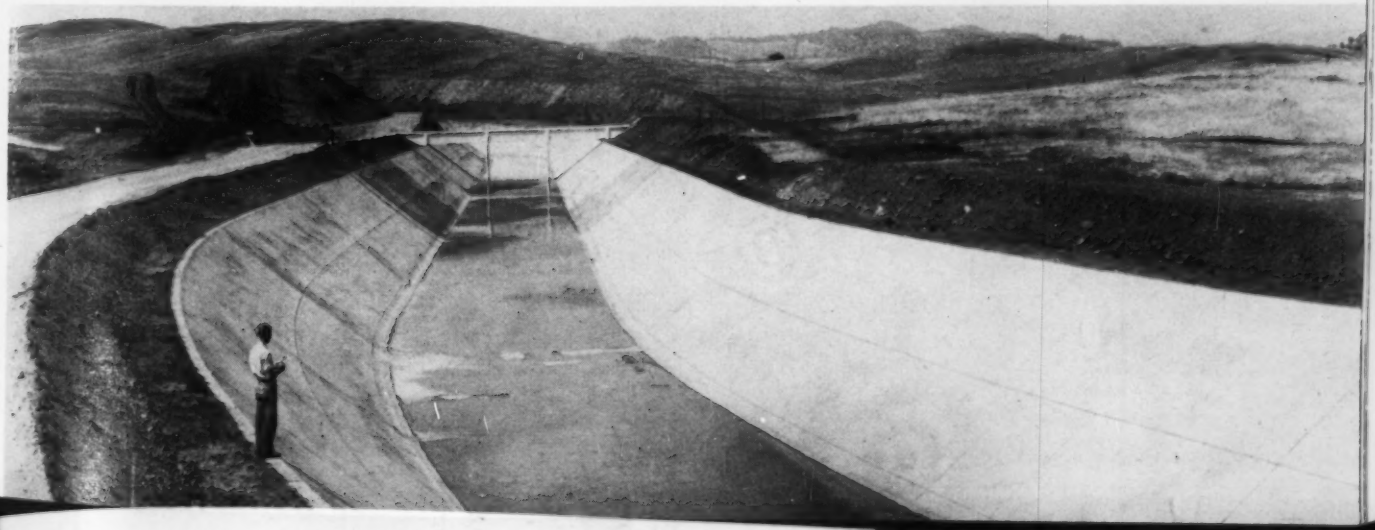
KINGS RIVER SIPHON, three-fifths mile long, 291-in.-dia reinforced concrete structure on Friant-Kern Canal (above, left), requires total of 3,994,000 lb of steel. View from poured section (above, right) shows placing of reinforcing steel. See also front cover of this issue.

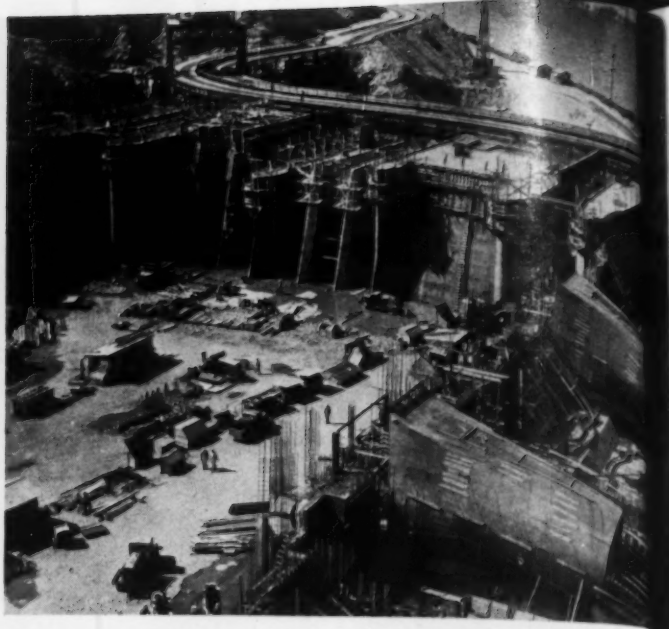




STEEL FOR 24-FT-DIAMETER CONCRETE PIPE is placed over erection jumbo (above, left). Longitudinal steel is composed of $^{3}/_{4}$- to $^{7}/_{8}$-in round bars. Circumferential steel is $^{7}/_{8}$-in. round to $1^{1}/_{2}$-in. square bars. Siphon is built in alternate sections, each $27^{1}/_{2}$ ft long, for construction convenience. Intermediate sections are poured after alternate sections are cured and forms removed.

FRIANT-KERN CANAL, designed with normal capacity of 4,000 sec-ft, with use of freeboard will carry 5,000 sec-ft. First 74 miles to Kaweah River is complete except for 10 miles of lining, and construction of St. Johns and Kaweah River siphons. Cost to June 30, 1948, is estimated at $25,670,000. Length will be 153 miles from Friant Dam to vicinity of Bakersfield, and estimated total cost is $57,547,000.





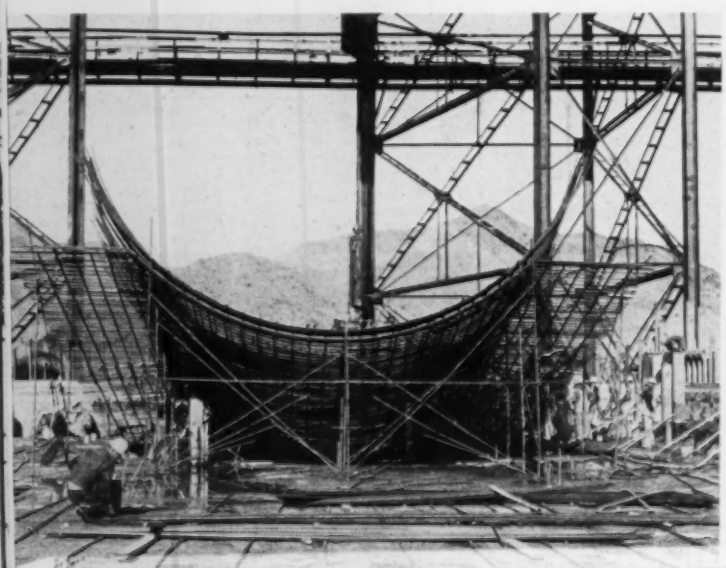
SCHEDULE OF ALL PHASES of construction work on Davis Dam Project on Colorado River, 67 miles downstream from Hoover Dam, is plotted over seven-year period on Control Schedules. Wooden forms for penstock transitions at Davis Dam (above, left) are constructed in carpenter shop area. Forms, which are moved into intake structure, are used in transition sections of penstock entrances. There will be five such penstocks, each carrying approximately 6,000 sec-ft of water at full reservoir. Concrete progress in spillway, outlet structure and intake structure (above, right) is seen from old switchyard area. Concrete in block S8 at right center edge of photo is at El. 520. Concrete in left and right outlets of spillway and outlet structure is at El. 560. Two penstock transition forms are shown in place in intake.

sources were devoted to wartime purposes. The only major works permitted to proceed were power installations at Coulee and Shasta Dams and a few transmission lines that were classed as contributing to the winning of the war. Irrigation construction and the opening of new lands for settlement were at a virtual standstill under War Production Board stop-orders from 1942 through 1945. By 1945 the amount of authorized work yet to be undertaken by the Bureau totaled close to four billion dollars.

Prior to the war the Bureau had relied largely on its annual budget presentation to Congress as a program and control of construction for the current year. Although prepared and presented in some detail, the budget presentation was based on sources of information such as progress reports, disbursement vouchers, and contractors' schedules, which were assembled in Washington, where the budget was put together. No formalized long-range programs or other systems of estimating were available from which to draw conclusions as to the financial needs of any particular year and its relation to subsequent years, nor did the Bureau prior to the war prepare a formalized short-range or annual schedule, laying out, in detail, work for the immediate future. It was customary after an appropriation had been made by Congress, to allot the funds appropriated to the project concerned. The money would then be spent to advance the work in line with the justification submitted to Congress, in the best judgment of the construction engineer responsible for the work in the field, and under the general supervision of the Chief Engineer in Denver.

Need for New Procedure Apparent

During the war there was every reason to expect that Congress would insist on rapid accomplishment of the Bureau's authorized program in the postwar era to provide the irrigated farms needed for veterans' homes and for an augmented food supply, and the added kilowatts required to meet the demands of the nation's growing industry and population.

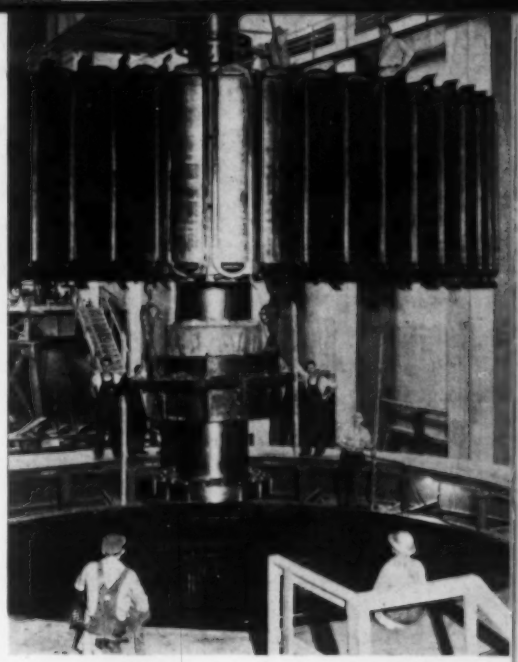


REINFORCING STEEL on downstream end of block P4 is part of mat which will surround 22-ft-dia penstocks at Davis Dam. Concrete in block P4 is at El. 505. Note cooling pipes in foreground of photograph.

The Bureau realized that, with such a tremendous dollar backlog of unfinished work, it would be very difficult to administer postwar construction according to prewar programming procedures and policies. A procedure had to be developed to integrate, in as scientific a fashion as possible, the requirements for labor, materials, supplies, and equipment on each of the Bureau's active construction projects. Manpower requirements of both the Bureau and the contractors must be analyzed, not in terms of the immediate future, but over a period of years. As a base for such planning, it was essential that reliable and accurate cost estimates, adjustable to current price indices, be always available. A watchful Bureau of the Budget, an economical Congress greatly interested in the cost of such undertakings, and the controlling requirement that substantially all costs must be returned by irrigation farmers and Western power users made accurate estimates doubly necessary.

The first step taken to meet the anticipated postwar work load was the reorganization accomplished in late 1943, which established seven regional offices to administer the Bureau's far-flung construction program close to the sites of the various projects. Construction engineers in charge of project construction were made administratively responsible to the regional directors while remaining technically responsible to the Chief Engineer in Denver.

The second step was to institute formal programming of the Bureau's work. To accomplish this end, a unit known as the Office of Progress Con-



ROTOR WEIGHING 450 TONS is installed on generator unit of 75,000-kw capacity in Shasta power plant. Total capacity of completed plant will be 379,000 kw. Installation dates are established on Control Schedules and appropriations are requested as plotted on schedule.

trol was established in 1945 in the Office of the Commissioner in Washington, D.C. Staffed with Bureau engineers and with men drawn from other agencies and from industry, the Office of Progress Control undertook to develop procedures and methods for laying out the Bureau's programs over a period of years and for planning construction in an orderly fashion. Procedures for long-range planning must be flexible enough to meet varying situations such as the amount of Congressional appropriations, availability of materials, supplies, and manpower, and the ingenuity of the American contractor, and at the same time rigid enough to keep the program moving forward on a prescribed path.

The Office of Progress Control devised two schedules for the solution of these problems. The first, identified as the "control schedule," breaks a project into its principal features, for example: dam, reservoir, power plant, irrigation canals, pumping plants, roads, telephone lines, transmission lines, etc. These features are set up on the left-hand side of a bar chart which runs to the right across a series of columns, each representing a fiscal year. The bar chart shows in what years the work on each feature will be done, and gives an estimate of the cost of that work for each year. Totaling the columns gives the dollar value of the project work for each year. The control schedule covers the "current year," the succeeding year which is known as the "budget year" (because it is the year under consideration by Congress in its annual budget review), and the five years following the budget year, a total of seven years. For example, the current year which begins July 1, 1948, is the fiscal year 1949; the budget year is the fiscal year 1950; and the five succeeding years extend through the fiscal year 1955.

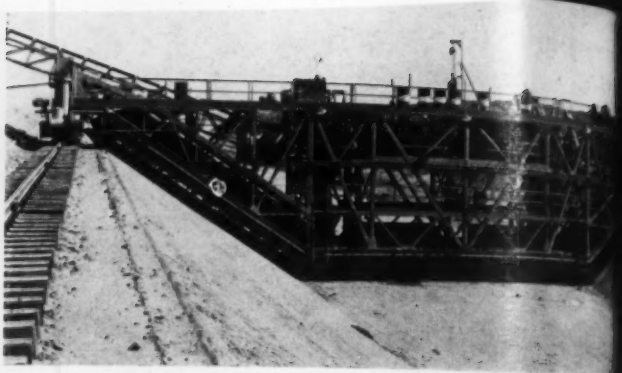
Annual Program Schedule

Separate and apart from the control schedule is the "annual program schedule," which takes the column on the control schedule for the current year, lists the features under construction and breaks them down into all important subfeatures. On the annual program schedule, a dam might well be subdivided into outlet works, spillways, embankment; a power plant into building, equipment, installation of generating machinery; and a distribution system into main canals (each of which is listed separately), principal laterals, and patrol roads. The features and subfeatures are listed on the left-hand side of the schedule, as on the control schedule, but the right-hand side is divided into twelve columns, one for each month of the fiscal year. In bar-chart fashion, similar to the control schedule, the annual program schedule shows the months in which the work will be done and the value in dollars of the work to be done in each month.

Accessory information is shown on the annual program schedule by flags, which indicate the principal administrative actions to be taken during the year, such as the award of a major construction contract, the negotiation of a repayment contract, the finishing of a major siphon, the installation of a generator, the beginning of delivery of irrigation water—all by dates and months. Flags are commonly referred to in Bureau parlance as "flagged actions."

The introduction of the control schedule and the annual program schedule in 1946 was an innovation in the Bureau of Reclamation. Since the Bureau operates as a civilian agency, it could not merely issue these schedules to the field services and say, "Here they are, fill in the blanks, return them to Washington, and see that you live by them ever after." Instead the Bureau had to show the field organization the value of the schedules and to explain in detail how they were to be prepared and used. Therefore a series of meetings were held in Washington and in the

TIMING OF CONSTRUCTION of subfeatures of dam is developed on Annual Program Schedule. Principal outlet works for Horsetooth Reservoir (below, left) is constructed in base of Horsetooth Dam prior to placing of fill for 1,855,000-cu yd earthfill structure in Colorado-Big Thompson Project. View downstream shows trashrack structure reinforcement steel in foreground and dome of 26-ft-inside-dia gate chamber in background. Chamber contains operating mechanism for two 5×5-ft high-pressure gates. Water coming through pressure conduit from trash rack is divided, passes through gates and is carried by two 72-in.-dia steel pipes to be discharged into stilling basin. Fleet of tractor-drawn sheepsfoot tamping rollers (below, right) compacts fill in early stages of construction.



RAPID ADVANCEMENT OF WORK made possible by special equipment often requires reprogramming of project work. Bed for Delta-Mendota Canal (above, left) is smoothed by motor graders as 13-cu yd Bucyrus Monighan dragline with 165-ft boom, in background, speeds work of digging huge ditch. Trimming machine (above, right) smooths canal banks prior to placing of reinforcement. Special machine, of similar construction, places concrete lining.

field, and Bureau personnel from Washington were assigned to work with the field offices in the preparation and assembly of the desired data.

Preparation of Control Charts

Although some organizational changes have since been made, the control schedule and the annual program schedule are still the official basis of control of the Bureau of Reclamation's work program. In actual practice the schedules are prepared as follows. The charts are first prepared by each project concerned; they are checked by the Chief Engineer to determine what the load will be in his office for designs and specifications; they are cleared with the technical branches of the Bureau such as Power Utilization (responsible for power rates) and Operation and Maintenance (responsible for repayment contracts), for adherence to the policies and procedures of these branches. The Program Division of the Commissioner's Office reviews the schedules for compliance with the Commissioner's policies and those of the Department, the Bureau of the Budget, and Congress. After review by all concerned, the control schedules and annual program schedules are approved by the Commissioner and become binding for the year for which they have been prepared, subject to revisions made through the same channels.

Schedules are prepared in the months of May and June, prior to the beginning of the fiscal year for which the schedules apply. For example, a new annual schedule is prepared in May 1948 for the fiscal year 1949, which begins July 1, 1948. At the same time the control schedule for the previous year is reviewed and brought up to date. The current year is dropped off, and a new year is added on the other end. During the first two years of use these schedules were not available on July 1. In fact, most of them were not approved until the first quarter or third of the fiscal year had elasped, because of the need for clearance with so many other units of the Bureau and the unfamiliarity of Bureau personnel with the new procedure.

Another factor in delaying the preparation of the schedules has been the late date at which Congressional appropriations have become available. For the fiscal year 1948, for example, the appropriation act was not passed by Congress until July 25, 1947, or a month after the fiscal year had begun.

During the period in which the program and control schedules and flagged actions were being developed and put into effect, not as much attention as desirable was given to the fiscal side of the picture, which was a responsibility of the Bureau's Office of Finance. Funds appropriated by Congress were allotted to the projects, and conforming expenditures to the approved programs were left largely to project personnel. No specific procedures were provided for direct control to insure conformity with Congressional and Budget Bureau action. Under the regulations of the Bureau of the Budget, available funds must be apportioned and approved by it for obligation on a quarterly basis. Under the Bureau's old procedure, these apportionments were approved without direct integration with the quarterly requirements of the Bureau's annual programs. Also fiscal reports made to the Bureau of the Budget, and available to Congress, on obligations and expenditures were not arranged to show their relation to Bureau programs, or to the budget and the action taken by Congress on that budget. Inaccuracies arose as a result of different interpretations, by engineers and accountants, as to what constituted obligations, earnings, costs, expenditures, disbursements, work schedules, and related items.

Former Confusion Between Carry-Over Funds and Unobligated Balances

During the Congressional hearings for the fiscal years 1947 and 1948 on the appropriation estimates for the Bureau of Reclamation, difficulty was experienced in correlating information prepared by the projects, for example, with an item of dollars in the construction schedules identified as "carry-over," representing unused money carried over from one fiscal year to the next. Much of the money included in the carry-over figure reflected a part of the current-year program which had not been accomplished on schedule and which had to go over until the following fiscal year, but the finance records of the Bureau, according to the finance definitions, listed these funds as "unobligated balances" or "free money," which Congress interpreted as being available for re-use in the following year, and therefore deducted from the estimates of appropriation submitted by the Bureau. A total of $107,000,000 was carried over from the fiscal year 1946 to 1947, and a total of $90,000,000 from 1947 to 1948. Since Congress considered these sums to be "unobligated balances," the Bureau

SUMMARIZING, the Bureau is anchoring its plans and specifications for the future to the Project Control Schedule, as the master document of the Bureau's program. Off the first column of the control schedule falls the Annual Program Schedule. Off the second column of the control schedule comes the budget for the next year. The five succeeding columns tell the story as to acres and kilowatts and other benefits that will be derived, when, and how much. From the annual schedule the Chief Engineer determines the design and engineering work that he must do. Also from this schedule comes allotment advice, that is, funds are allotted to a project for expenditure solely in conformity with the schedule. From the annual schedule is quickly and easily determined the apportionment of funds approved by the Bureau of the Budget on a quarterly basis. Supporting the annual schedule, and reconciled to it, is the detailed Schedule of Contract Earnings and Other Costs which shows, by months, individual allotments to contractors to keep them within the available funds.

was denied all funds necessary to meet contract payments under the program for the approved year. Contractors who brought themselves back to their original schedules not only earned the so-called carry-over funds, but also consumed the funds available for the current year in a relatively short time; the Bureau had no legal or practical way of preventing such exhaustion of its funds.

New Organization Combines Programs and Finance

With an actual expenditure of approximately 200 million dollars in the fiscal year 1948, a possible expenditure of 300 million dollars in the fiscal year 1949, and more scheduled for later years, action obviously had to be taken to bring programs and finance, including budgets, into closer coordination. In June 1947, the Commissioner of the Bureau of Reclamation recommended, and the Secretary of the Interior approved, the obvious and logical action of merging the Bureau's Progress Control and Finance organizations into one, literally designated as the Office of Programs and Finance. Responsibility for annual program and control schedules, financial reporting and Bureau-wide accounting was vested in the new organization, which was staffed with engineers and accountants.

Interested officials had some misgivings as to whether the new Office of Programs and Finance would be productive of reliable programs and budgets and accurate accounts. Such misgivings have not been borne out. Both the groups composing the new organization recognize that much of the success of the Bureau's activities depends on their efficiency and ability in developing realistic programs, in justifying these programs before Congress, and in guarding the expenditure of available funds to conform with such justifications and programs. While part of the past year has been lost in merging the two organizations, in eliminating the various kinks and bottlenecks that develop with such a merger, and in handling emergency assignments such as obtaining additional funds for projects faced with exhaustion of funds, considerable progress has been made in clarifying the handling of the Bureau's program and related fiscal work.

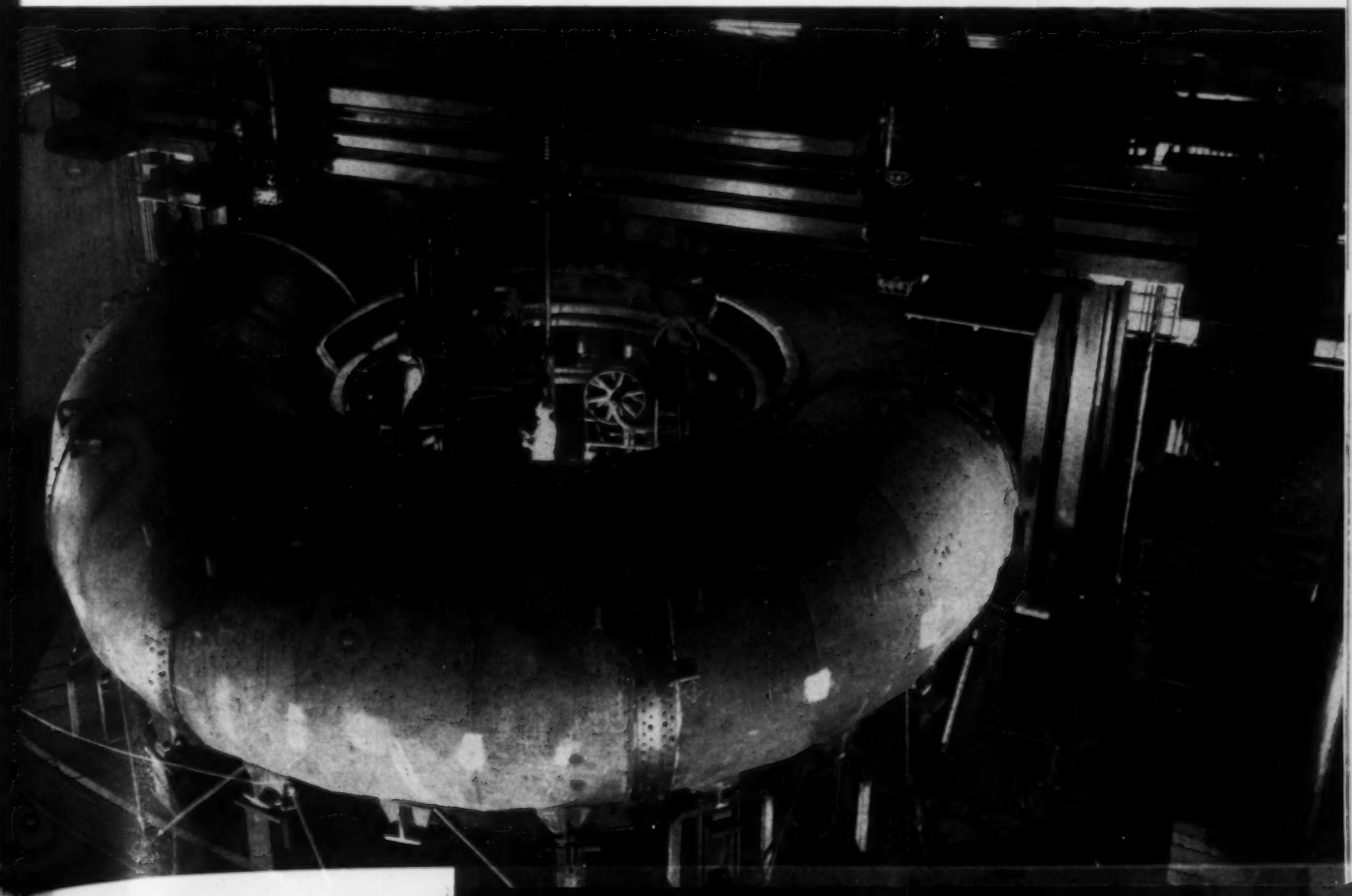
Detailed Analyses Prepared for Congress

The problem of obtaining additional funds for projects faced with exhaustion of funds became a serious matter during the winter of 1947–1948 on four major projects—Columbia Basin, Central Valley, Davis Dam, and the Colorado–Big Thompson. In preparing material to show Congress the status of funds on these projects, detailed analyses of the annual project program were prepared. These analyses showed, for each major contract with a face value of over $10,000, the earnings by months for the fiscal year on an actual basis for the elapsed part of the year and on an estimated basis for the remainder of the year. Other costs were simi-

(*Continued on page 80*)

Casing for Shasta's Fifth Hydraulic Turbine

SPIRAL CASING for fifth Shasta Dam hydraulic turbine rests just clear of revolving table of 40-ft boring mill in Allis-Chalmers' Milwaukee shops during machining of speed ring. Casing, constructed in seven sections with riveted buttstrap joints, has total weight with speed ring of about 360,000 lb. Greatest diameter is 56 ft and speed ring inside diameter is 18 ft. Upon completion, turbine will join four similar units at Shasta. All are rated at 103,000 hp at 138½ rpm under 330-ft head.



Los Alamos—
The Town the Atom Is Building

$175,000,000 Five-Year Construction Program in Progress

WILLIAM N. CAREY, M. ASCE

Executive Secretary, American Society of Civil Engineers, New York, N. Y.

BIRTHPLACE OF ATOM BOMB, Los Alamos, N. Mex., is flourishing city of 9,000 located on a high mesa in mountains near Santa F Early spring aerial view shows new city which is gradually replacing super-secret war-built town. New housing construction is unde way in center foreground and extensive residential development in left background.

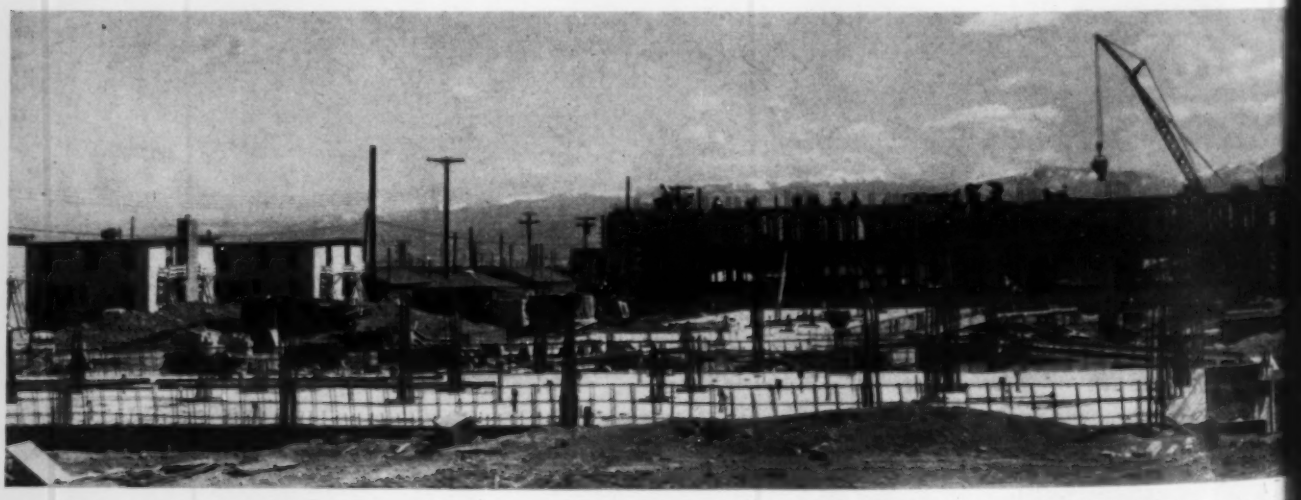
ON A HIGH, rolling mesa, 35 miles northwest of Santa Fe, N.Mex., encircled by canyons and mountains, lies the unique town of Los Alamos. It is like other American towns of its size in many respects, but in others it could not be more different. It now has an on-site population of 9,000, with about 4,000 more, including construction personnel, from "outside" during work days. It isn't a walled city but it might as well be, for its boundaries are marked by a high, guarded, climb-proof fence.

Where the Atom Bomb Was Born

Los Alamos is the birthplace of the atom bomb and now is the United States center for research and development of atomic weapons. Originally, it was the lonely site of a boy's school. A war-inspired, super-secret barrack town sprang up there overnight, midway during the war. Today, a $175,000,000 five-year program of permanent-type construction is well started, under direction of the Atomic Energy Commission.

A good highway leads to Los Alamos, well paved and maintained. But there is no Los Alamos Chamber of Commerce to extol the virtues of the town and to persuade businessmen and industrialists to settle there. No glad hand greets the casual visitor. At the town limits the road is barred by armed, security police of th Atomic Energy Commission. Ov 600 of these husky young men a employed, all in blue-gray uniform of snappy and serviceable desig complete with shoulder patch.

The tourist can travel the road t ward the town and look at the scener en route but none gets through th city gate unless he has a pass. Ge ting a pass is less time-consuming tha getting a passport for a Europea tour, but Los Alamos passes are i sued more carefully than mos United States passports. In additio a pass-holder, once in, must be signe for by someone "inside" before h can get out again.



NEW HOUSING CONSTRUCTION includes group of 252 "efficiency apartments" scheduled for occupancy this fall. All concrete aggr gate for such construction must be hauled 7 miles uphill for total lift of 2,000 ft.

The town is owned and operated in its entirety by the federal government through the Atomic Energy Commission. No other governmental authority prevails in Los Alamos. No state officer, county sheriff or town constable has any jurisdiction there. For municipal purposes a town council is elected by the residents. These residents enjoy all the usual municipal benefits such as schools, playgrounds, paved streets, gas, electricity, water supply, sewers, garbage collection, etc., but they pay no general municipal taxes and, of course, no property taxes.

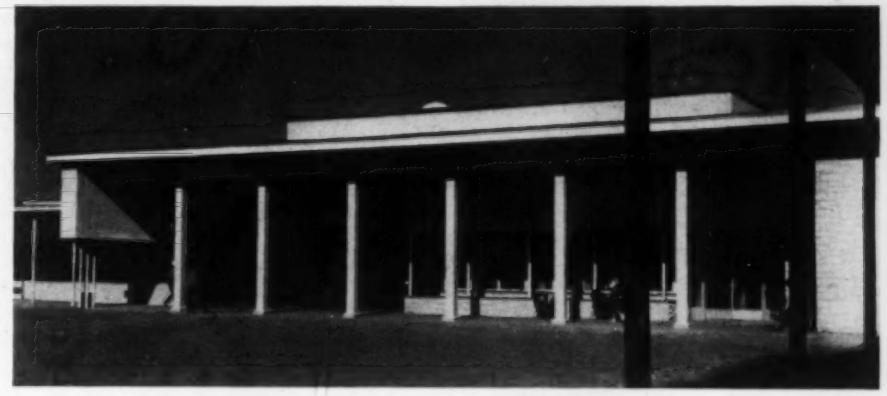
Early in 1946, Lawrence V. Sheridan, M. ASCE, of Indianapolis, was engaged as town planning consultant. He developed the initial "model town" plan under which construction began in June 1946. Last fall (1947) the initial plan was enlarged to a "master plan" for the ultimate development of the town. The master plan was prepared by W. C. Kruger and Associates under direction of the Atomic Energy Commission.

Los Alamos is now experiencing a residential building boom of major proportions. The wartime barrack town is being made over, and now has about 1,600 new homes, many of them permanent-type construction. Bids are now being advertised for the construction of 700 more houses, with more to come. Apartments too are under construction. One group of 252 "efficiency apartments" of concrete and tile is well along and will be ready for occupancy about August 1.

A gas range, a gas hot-water heating plant and an electric refrigerator are part of the government-furnished equipment for every house. A two-bedroom house rents for $45 a month, and $65 rents half a duplex with three bedrooms. The cost of all gas, water, and electricity used by the householder is billed on a flat-charge basis. And, just in case a break in the natural gas line now supplying the town should occur some day, a propane plant with 270,000 gal of storage capacity is being built "inside."

New Recreational and Shopping Center

An entertainment and shopping center costing $2^1/_2$ million dollars is about complete. On a plot about 1,000 ft square, with an open square inside, this "center" has everything from a beautiful 1,000-seat theater and a big supermarket down to a beauty shop. It has a drugstore of the size and type found in downtown Los Angeles or Miami. It has bowling alleys and billiard rooms, a barber shop, shoe store, dress shop and men's clothing store.



SHOPPING, ENTERTAINMENT AND RECREATIONAL facilities are comparable to those of modern communities of much greater size. Supermarket (above) and modern 1,000-seat theater (below)—of stone and concrete with rough finish—follow architectural style indigenous to region.

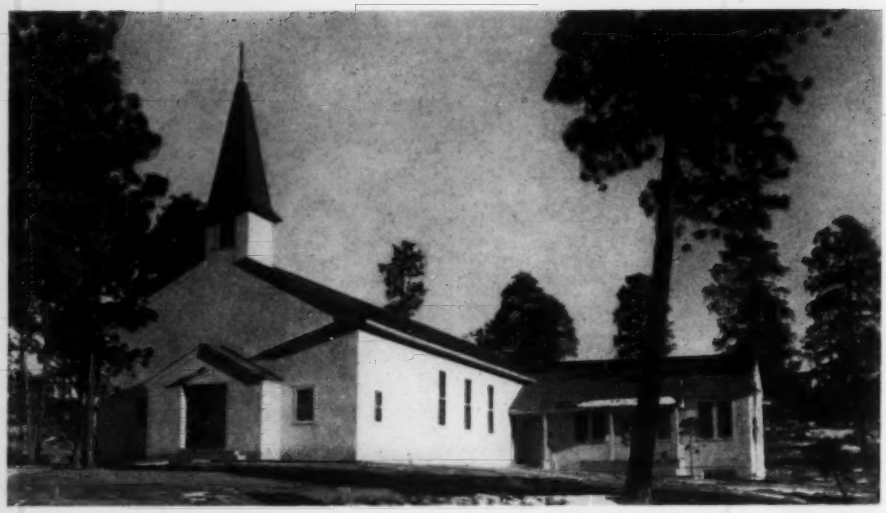
The supermarket, stores and all shops are operated under concession contracts. Both prices and quality of foodstuffs and other merchandise are high. Prices generally are no higher than in most large cities but quality is, because of federal supervision. And, as though to prove the metropolitan character of the "center," the day the writer visited it, men with jackhammers were tearing up a section of new, wide, concrete sidewalk.

The town, and all the people of Los Alamos, are there for but one purpose—to construct all necessary facilities and to operate the odd-appearing factories grouped behind another high wire fence at one side of the townsite. The townspeople call these factories "laboratories." The present laboratories and scientific facilities are located in a small area extremely crowded and consist almost entirely of temporary wartime structures. A project is being developed for the construction of new laboratories on another mesa separated from the town by a canyon. This project is estimated to cost $100,000,000 and is part of the present five-year construction program.

The atom bomb was designed at the Los Alamos Scientific Laboratory. Three years ago the first atom bomb was exploded on the desert west of Los Alamos, and its fateful repercussions are yet but dimly understood. The present objective of the Los Alamos Laboratory is to continue the design and production of atomic weapons, and the conduct of research and development. Carrol L. Wilson, General Manager of the Atomic Energy Commission, recently stated that the military interest in this research and development "goes far beyond atomic bombs." Obviously, this also is true of developments adapted to civilian use.

Laboratory Has Been Operated Since 1943

The Los Alamos Scientific Laboratory has been operated since 1943 under the immediate direction of the University of California. The university first operated under contract with the War Department and now is under contract with the Atomic Energy Commission. The original laboratory staff of some 30 scientists and engineers has grown to more than a thousand.



COMMUNITY NEEDS IN LOS ALAMOS are met by church and three twelve-room school buildings, consisting of two grade schools and one regulation high school. Present expansion program includes further development of church and school facilities.

The influx of scientists to Los Alamos and the removal of military control has resulted in important academic developments in this strange place. Classes at university and graduate level are conducted in the laboratory throughout the year in physics, mathematics, chemistry, and metallurgy. One authority has stated that Los Alamos has "probably the best equipped physics research laboratory in the world." Among the many academic activities of the laboratory is a training program in the relatively new field of radiochemistry.

Provision is made to enable future scientists to take advantage of the extraordinary facilities of the Los Alamos Scientific Laboratory. A university affiliation plan has been developed which will permit the employment of university students at the laboratory while doing research work leading to advanced degrees.

Education of the children of the town also is provided for quite adequately. In operation now are three schools, each of about twelve-room capacity. Two of these are grade schools and one is a regulation high school. Reasonably good hospital facilities are available at present, with a big, new hospital about to be constructed. It is planned to advertise for bids next July for a $3^1/_2$-million-dollar, 150-bed hospital and medical research center. The medical research will be centered about radioactive materials—their destructive and their curative effects on human beings and other living creatures and things.

What Is Fissionable Material?

In case some readers may not be entirely clear as to what "fissionable material" is, the following definition is quoted from a news item in the newspaper, *Los Alamos Times* of April 16, 1948. The story first referred to the Atomic Energy Act of 1946 and said: "As defined in the act, the term fissionable material means plutonium, uranium enriched in the isotope 235, or any other material which the commission determines to be capable of releasing substantial quantities of energy through nuclear chain reaction of the material."

Still more uncommon to newspaper columns is the explanation the same reporter then made as to why "uranium 233" is now considered fissionable material. The reporter cleared it all up to his Los Alamos readers by stating simply: "Uranium 233 is derived from thorium 232 in the same way that plutonium 239 is derived from uranium 238."

Water supply and sewage and waste disposal are problems at Los Alamos. Water supply has been the subject of an exhaustive study by Black and Veach, Members ASCE, consulting engineers of Kansas City, Mo. Present sources consist of small mountain streams and springs and a series of deep wells in Alamos Canyon east of and below the town. Consumption is about two million gallons per day. Present wells average about 1,000 ft in depth and the average ground elevation of their pump houses is 4,500 ft. Through a 9-mile-long pipeline, water is pumped against a total static head of about 3,000 ft. Summer pumpage averages about 600,000 gpd. Additional wells are now being drilled, the first new well being nearly 2,000 ft deep.

Water is used in Los Alamos about as in any other town. With a little care and enough water, beautiful lawns are produced. This spring some 20,000 trees were being added to the natural growth among the housing areas. These alone will take quite a little water for some time. With landscaping, paved streets, lawns and trees, Los Alamos is taking on rapidly the appearance of a storybook, model town.

Serious Problem of Radioactive Wastes

Sewage and waste disposal is relatively routine except for the waste products of the laboratories. That exception is a big one, and introduces something new to the problems of the sanitary engineer. Even the dust in the air of these factory-laboratories presents a serious disposal problem. As fissionable material in the future becomes a powerful tool of mankind instead of its scourge, these problems of disposal of radioactive wastes will loom large, and the engineers of tomorrow must solve them.

This waste disposal problem is almost a total unknown to the engineer of today. All he can do is to play it as safe as his common sense dictates and hope for the best. We are told that the radioactive properties of many of the laboratory materials dissipate slowly. Use of the word "slowly" in this sense is gross scientific understatement. For we are also told that any given amount of many of these radioactive materials, if left alone, will have half its radioactive strength left 50,000 years hence.

All this is pertinent to the disposal problem. Suppose for example that a pair of overalls belonging to one of the workers in these strange Los Alamos factories, on checking, is declared unfit for further use because

FOURTH STREET AND TRINITY DRIVE. **Permanent-type single-family units are located in natural setting in residential section of Los Alamos. Street paved with asphaltic concrete has concrete curbs, gutters and sidewalk.**

it has absorbed the safe maximum loading of radioactivity. The overalls cannot be sent to the laundry, tossed in a waste can or bundled for shipment to a paper manufacturing plant. They are radioactively loaded, and a possible source of harm for perhaps 50,000 years to anyone who comes in protracted contact with them. Burning them doesn't change their radioactivity materially. Question—what to do with Professor Smiths' overalls and the other odds and ends of factory wastes? Engineers at Los Alamos have adopted temporary expedients but the required permanent solution is still being sought.

Stocking radioactive wastes or burying them inside walled or fenced-off areas in isolated places has been offered as a disposal method. The harmful life of these wastes—thousands of years—exclude that easy solution. Man is constitutionally careless, and time breaches all walls or fences.

The disposal of so slight an item as a pair of overalls is cited to emphasize the complexity of the problem concerning disposal of radioactive wastes of the atom-powered future. Disposal of waste radioactive solids, liquids and of dust, especially dust, on any scale commensurate with the potentialities of fissionable materials in industry poses problems of staggering proportions and ramifications.

Sewage Must Be Pumped

In spite of the high altitude of the town, about 65 percent of its sewage must be pumped. Five sewage lift stations are required. Los Alamos probably is the only mountain town in the country which pumps any large proportion of its sewage. Here, the peculiar topography, plus some unique collection problems, left no other practical alternative. The treatment plant for domestic sewage is of the conventional trickling-filter type, with separate sludge digestion. Treatment of industrial and radioactive wastes is a separate problem. The devastating effect of radioactive sewage on any of our biological process treatment plants can be imagined. Exhaustive research on this problem is being conducted but these activities are still classified as "secret."

Construction and Personnel Problems Difficult

One of the serious difficulties of carrying on at Los Alamos the volume of construction contemplated is due to the isolated location of the project. The nearest rail point is at Santa Fe and all materials brought into the project must be hauled some 35 miles, partially over mountainous roads with steep grades and sharp curves. The labor market in the area is extremely critical as the nearest city of any size is Albuquerque, by road some 110 miles to the south. The labor situation is further intensified by the shortage of housing and the necessity in the past year of excluding construction contractors' personnel from living in Los Alamos so that there could be sufficient housing for operational and staff personnel.

Plans are under way for construction of a camp for contractor personnel, and it is anticipated that this camp can be made ready for occupancy by next October. The camp will house approximately 2,000 people and is located some 7 miles from the project gate. It will provide, in addition to housing, essential community facilities including a school.

The construction problem is further accentuated by the security requirements of the project. As the entire area is controlled, all admission is by pass. All workers on the project and employees of the Atomic Energy Commission or its major contractors must be cleared by the F.B.I. prior to admission into excluded areas. Every employee, whether he be supervisory, craftsman, or laborer, must obtain this clearance prior to his actual entry into these areas. Clearance investigation generally requires three to four months, so one can imagine the difficulties in the problem of recruiting.

Because of its relative isolation, the social activities of the town are important, and they are many. There are bowling teams for men and women, baseball teams, amateur theatricals, concerts with local and imported stars, the movies, lodge activities such as those of the Masons and the Knights of Columbus, a riding club, golf, hunting and fishing clubs, the American Legion, the PTA, women's clubs, Girl Scout and Boy Scout troops and many other social and recreational groups. All these activities are home grown and home managed, full of pioneer vigor and enthusiasm.

Although isolated to a degree, Los Alamos is no farther from the rest of the world than any other mid-continent town on a major commercial airline. Los Alamos has a first-class airport but it isn't on any commercial airline. However, Albuquerque is, and Los Alamos runs a daily, ten-flight shuttle service between the two airports. It is a 30-minute ride, and flights are seldom closed in by weather. A transcontinental mainline railroad also runs through Albuquerque.

Atom-Town Has City Manager

Los Alamos has a head man, a city manager, plus. The "plus" covers his supervision of laboratory activities and personnel. He is Carroll L. Tyler, and he carries the official title of "Manager, Santa Fe Office of

(*Continued on page 82*)

COMPONENTS OF PREFABRICATED "SKR" TRUSS BRIDGE are assembled by stiff-leg derrick and traveling crane in constructing temporary crossing to replace destroyed Kaempfelbach Bridge on Frankfurt-Munich superhighway in Germany. Bridge formerly consisted of 13 half-circular concrete arches.

U.S. Army Engineers Reconstruct German Superhighway Bridges

WERNER H. GUMPERTZ

Formerly Head, Structural Unit, Operations Branch, Office of the Chief Engineer, U.S. Army, European Command

DESTRUCTION OF MOST major railroad and highway bridges by retreating German forces early in 1945 has given engineers an excellent opportunity to study the primary and secondary effects on bridge destruction. Much ingenuity and many unorthodox methods are being used in restoring these bridges with the limited means available. The short descriptions presented here, pertaining to the restoration of Germany's famed autobahn crossings, cover only a small phase of the bridge reconstruction work undertaken by the U.S. Army Engineers in Germany. Many other interesting situations similar to those related, have been encountered in which bridges have been restored to traffic with a negligible amount of scarce construction material. As semipermanent structures will gradually be replaced by permanent ones, new problems will have to be faced and solved according to the needs of each particular case.

STUDIES OF DESTROYED German bridges permit certain obvious deductions. As expected, all steel bridges proved to be easily destructible and well adapted to speedy reconstruction. Exceptions in this category were most, if not all, suspension bridges, comparatively few of which were to be found in Germany. Two suspension bridges, both highway bridges crossing the Rhine near Cologne, were completely obliterated. Since the stiffness of such bridges is small compared to other structures, no large sections remained undamaged when the cables were cut.

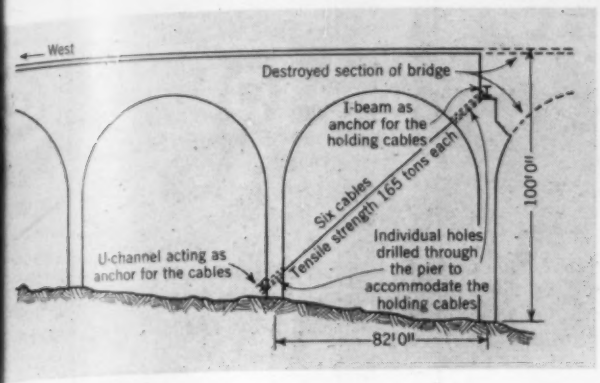
Most truss bridges and many plate-girder bridges—the latter a German favorite—could be salvaged without great difficulty. These bridges were usually broken in one or two places without being excessively twisted. They were lifted to a horizontal position and the pieces were placed on a temporary shoring. The damaged parts were then cut off and replaced by specially prepared new components. Piers and abutments, usually made of concrete or masonry, suffered relatively less damage. In most cases, some patchwork and a set of new bearings was all that was required to complete the reconstruction.

A different problem was presented by reinforced concrete, plain concrete and masonry bridges. During the last two decades the massive bridge had become very popular with German engineers, especially for small and medium spans, but also for some of the large viaducts. This preference was partly the result of Germany's armament program, which left only small quantities of steel for non-military construction. As a consequence, a great number of plain concrete structures of arch design had been erected.

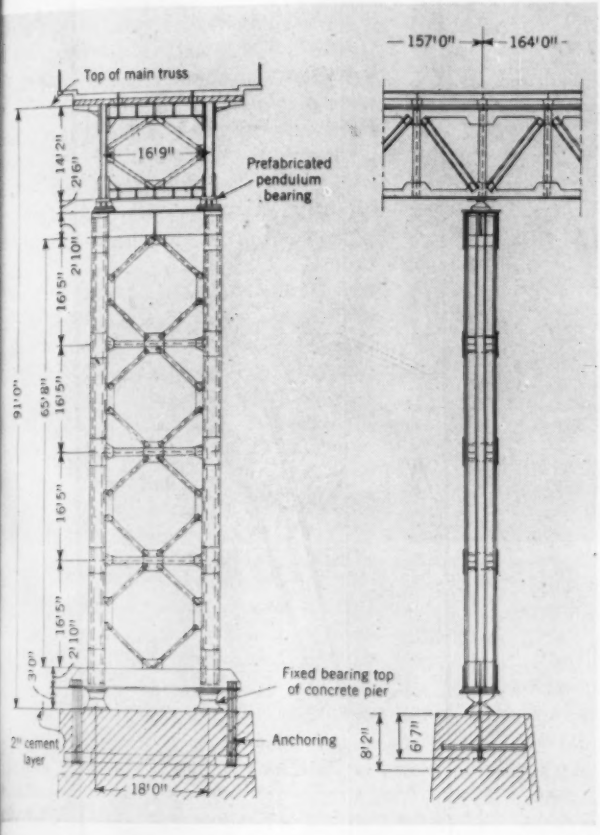
The greatest single undertaking of German engineers in recent years was

BOLTED "SKR" TRUSS is suspended from temporary cantilevering truss assembled atop remaining concrete arches in reconstructing Kaempfelbach Bridge near Pforzheim, Germany.

Kaempfelbach Bridge on the Frankfurt-Munich Superhighway


West
Destroyed section of bridge
I-beam as anchor for the holding cables
Six cables
Tensile strength 165 tons each
100'0"
Individual holes drilled through the pier to accommodate the holding cables
U-channel acting as anchor for the cables
82'0"

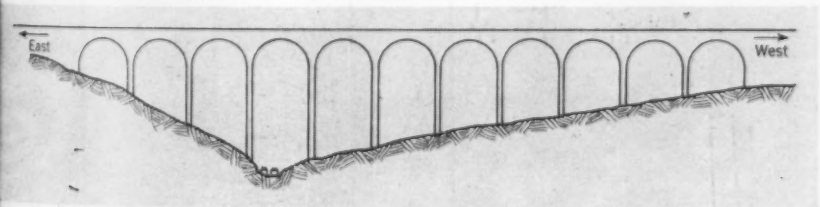
TIE-BACK (left) is used to hold last pier, in section of bridge not destroyed, against one-sided thrust caused by unbalanced arches at western end of crossing. Low height of pier permits use of steel pipe shoring (above) to brace single remaining arch at eastern end of structure.

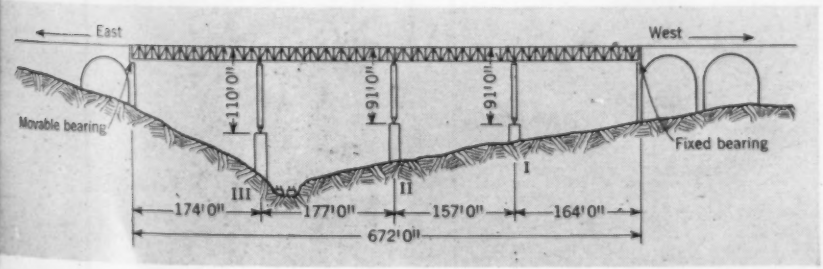


THREE PENDULUM PIERS (left) of prefabricated steel sections, with exception of top and bottom pieces at bearings, support steel truss constructed as continuous beam.

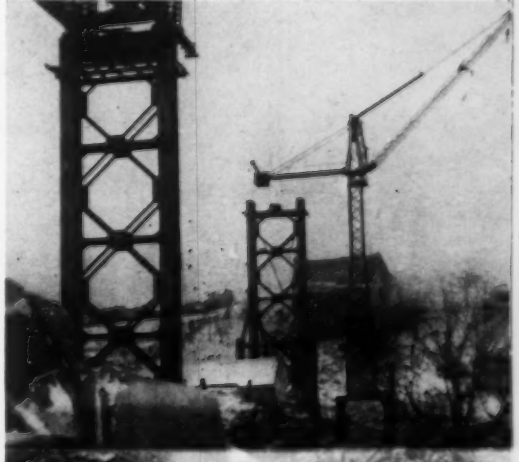
STEAM SHOVEL (right) removes debris from pier stub as temporary "SKR" truss is assembled on bridge deck in background. Railroad main line is seen in foreground.

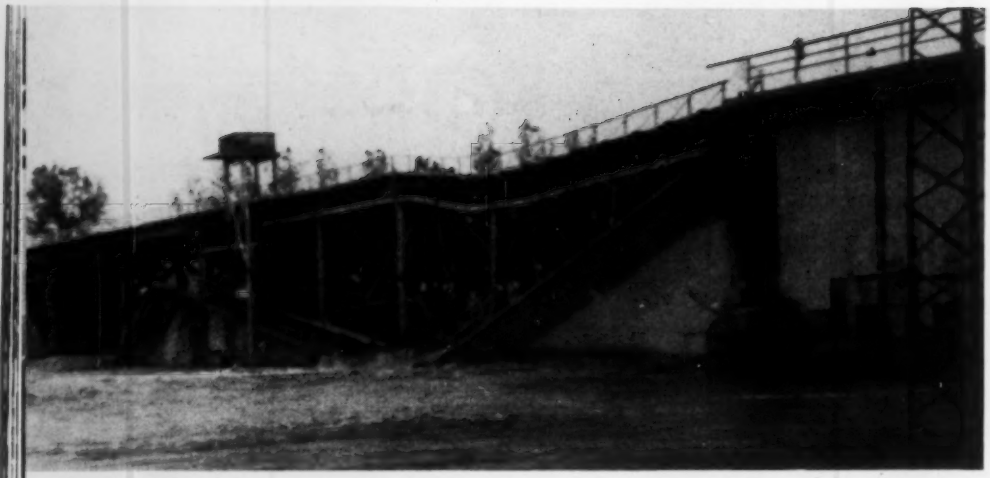
EIGHT OF THIRTEEN non-reinforced concrete arches which formed original viaduct (below) are replaced by "SKR" steel truss bridge on rocker piers (lower view).





TEMPORARY SHORING supports rocker-type piers before connecting with main trusses. In view (below) main trusses have reached first pier. Note counterweighted boom of gantry crane used in erecting steel.





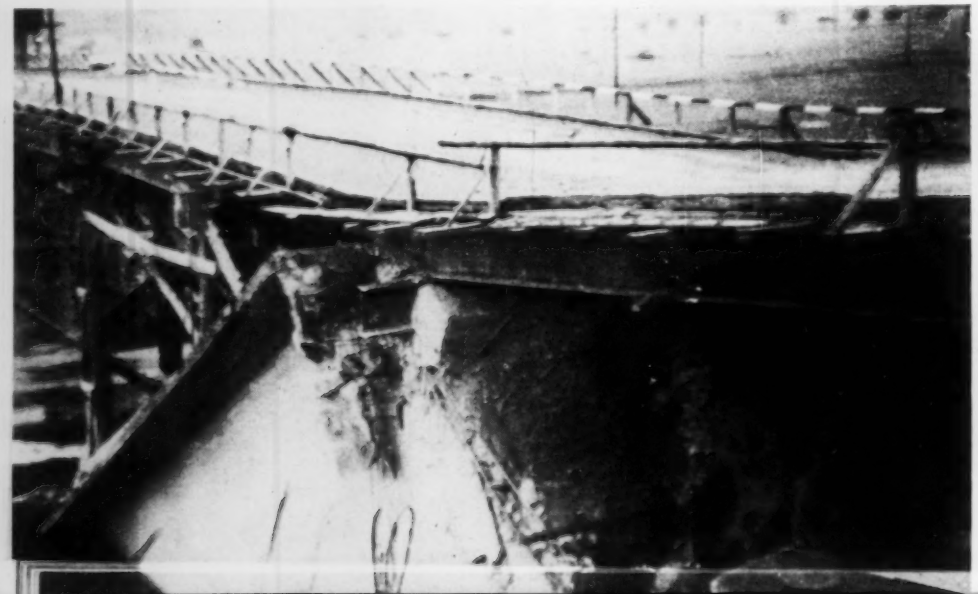
COLLAPSED ARCHES (above) of bridge on superhighway from Stuttgart to Munich support timber bents of emergency bridge. Sag in emergency bridge is caused by settling of destroyed arch. Third bridge on concrete blocks (below) is constructed over emergency crossing to correct for sag.

a vast system of strategic superhighways interconnecting all parts of Germany. These highways were built according to a standardized design, which included two lanes in each direction divided by a center strip. There were no crossings at grade and only slight grades and curves. A great number of overpasses, underpasses and viaducts, the majority of them concrete, were therefore incorporated in the system. This article deals primarily with the bridges that were built as part of this superhighway system.

Very few of the destroyed concrete bridges could be rebuilt easily. In the case of multiple-arch bridges, the destruction of one or two arches usually meant destruction or damage to some of the others. Once an arch was out of commission, the horizontal thrust of the remaining arches started working in the direction of the gap, thus causing the collapse of additional arches. The piers were usually designed in such a way that the horizontal thrust from one arch would substantially cancel the thrust from the next one, so that only vertical or nearly vertical forces had to be transmitted to the foundations. The arches themselves were hardly able to absorb the stresses resulting from the changed conditions because they were designed strictly for compressive stresses and with little or no steel reinforcing.

Besides the bridges that were abandoned or detoured, three main phases of reconstruction could be noted. The first phase was the emergency reconstruction carried out by the U.S. Army Engineers during the advance of the Allied armies. This type of bridge construction was accomplished mainly with timber bridges and trestles, sometimes using heavy I-beams as stringers. The well-known Bailey bridge also was frequently used. These structures were erected in haste, often without proper foundations and in many cases were founded on the debris of the destroyed spans. Such bridges soon began to settle, to show signs of wear, and to present a hazard to traffic. In the second phase, semi-permanent bridges were erected, using

CROSSBEAM SUPPORTING STEEL STRINGERS (below, left) of emergency crossing shown in views above rests precariously on tilted arch abutment. Concrete shows dangerous shearing cracks, beginning at edge of lower flange and extending along area in contact with concrete slab. Typical timber bents (below, right), resting directly on slanting deck of destroyed bridge, are endangered by high water of Neckar River.



such materials as could be readily secured. The third phase, now beginning, will see a gradual rebuilding of many bridges in their permanent form, according to either the original or new designs. The construction of permanent structures progresses very slowly because of the scarcity of construction material and equipment, as well as the very low productivity of the German worker. Most of the more important bridges now in use are of the semipermanent type.

To illustrate some of these statements, three bridge reconstruction jobs will be briefly discussed. The first is a semipermanent solution; the second is a repair job on a temporary bridge while a permanent bridge is being erected at the site; and the third is the reconstruction of a plate-girder bridge in its original form.

Kaempfelbach Multiple-Arch Bridge

The Kaempfelbach Bridge, near Pforzheim, is a link in the Frankfurt-Munich superhighway and spans a wide valley. Thirteen half-circular plain concrete arches form the 1,200-ft-long viaduct, rising up to 190 ft above the valley floor, which is traversed by one of Germany's important railroad trunk lines. When reconstruction work started late in 1946, the first task confronting the Army Engineers and civilian contractors was the removal of a tremendous mass of concrete rubble in order to expose the stubs of three of the seven destroyed piers. These three piers were to accommodate the new semipermanent steel structure.

There was also the problem of securing the undamaged arches against the danger of collapse due to one-sided thrust. The east end of the viaduct was simply secured by bracing it with very heavy structural steel pipe, as shown in an accompanying illustration. This solution was made possible by the relative shortness of the last pier. At the west end another method had to be used to keep the 100-ft-high pier from giving way. A heavy I-beam was placed near the top of the pier where the neighboring arch had broken off, and slanting holes were drilled through the concrete to accommodate six steel cables, which were anchored at the foot of the next adjoining pier. The cables, each of 65-ton capacity, were held on the other end of that pier in a U-channel and tightened by turnbuckles.

To close the 672-ft-long gap in the bridge, German "SKR" trusses were selected. SKR is a heavy prefabricated German railroad war

BROKEN SECTION OF PLATE-GIRDER BRIDGE (extreme right) is supported by ends of twin railroad bridges in railroad yards at Karlsruhe. End of girder is held in twisted position by crossbeams and stiffeners. Half of truss of nearest twin bridge in background rests on temporary timber bent. Falling plate girder cut off other half of truss.

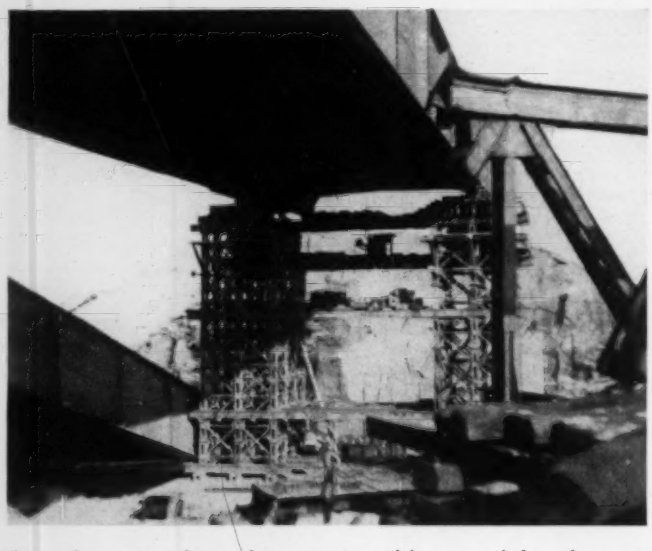
bridge, made up of standardized parts which are connected by bolting. Large quantities of assorted parts for this bridge had been captured from German army stocks and were readily available. Rocker bents were selected as intermediate piers because they alone were narrow enough to fit the existing pier footings. The clearing away of rubble progressed slowly because explosives had to be used with extreme care. The heavily traveled railroad line could not be disturbed, and there was a suspicion that some of the piers might still contain live explosive charges. Every German bridge contains a "blasting chamber" at the foot of each pier to facilitate efficient destruction in a war emergency. The suspicion proved to be well founded, as several 500-lb live aerial bombs were removed from the chambers.

At the same time, the tops of the end piers were readied to receive the steel truss which was to be carried through to the other end as a continuous beam, with three intermediate rocker supports. To launch the truss without elaborate staging, some of the bridge components were assembled temporarily on the western bridge deck above the last arch. This span was then extended outward as a cantilever. The final trusses were assembled by suspension from this temporary cantilever structure and were carried forward toward the other end of the viaduct. This operation was made practicable by the great speed at which the SKR truss can be assembled and disassembled.

In the meantime, a traveling crane began to assemble the first rocker bent. This bent, too, was assembled from available prefabricated steel sections, with the exception of the top and bottom pieces at the bearings, which were specially fabricated in a steel mill and assembled at the site. Temporary shoring held the pier in a vertical position until it was connected with the main trusses. Erection then continued in an easterly direction, the temporary span remaining on top of the permanent one to serve as a counterbalance for continued cantilever erection.

To offset the deflection of the free cantilever end, the trusses were not set on their final bearings at this time, but were placed directly on the abutment. Enough clearance was thus obtained by superelevating the free bridge end to clear the second rocker pier, which was being erected simultaneously. This pier was also shored with the use of some SKR components to keep it stable. Erection of the main trusses continued eastward.

Meanwhile, when the debris was cleared from the stub of the easternmost pier to be used, a crack and dislocation were discovered. Since this pier was very close to the railroad line on a rather steep slope, it proved difficult to remove the dislocated concrete. No cranes or heavy equipment could be brought in because of the unfavorable topography. Cold weather caused further delay in pouring concrete to bring the pier up to the level required before it could receive the rocker bent. After



HYDRAULIC JACKS (above) are used in lifting fallen span shown in view on preceding page. Pit in foreground is prepared for concrete foundation for temporary supports.

RAISED END of girder bridge (left) rests on temporary steel piers prior to construction of concrete abutment. Note end of half-truss railroad bridge in right foreground.

the pier was brought up to this level, the main trusses were extended until the end of the span was over the third pier.

The crane could not be used for the erection of the pier because of the slope and the railroad right-of-way. Therefore the whole pier was erected by two traveling stiff-leg derricks placed on the free end of the main span. In spite of the length of the cantilevering part (165 ft) and the resulting considerable deflection, even the heavy end pieces of the bent were safely hoisted up until the span could be connected with the pier and extended to the east abutment. The temporary truss on the west end was then removed and the bridge placed on its permanent bearings.

The final step in this construction job was the placing of the roadway, which had to accommodate one traffic lane in each direction as compared with two lanes in the standard cross section of the superhighway. In order to facilitate the roadway work, the reinforced concrete sections were prefabricated near the site by setting wooden forms on the unused pavement of the highway and casting the slabs in them. Each form was used for the pouring of three or four sections. Three of the slabs, placed transversely, formed the width of the roadway; the outside slab sections contained an integrated catwalk.

Meanwhile, the bridge had been prepared to receive the concrete slabs by the installation of steel brackets and supports. Erection was accomplished in a remarkably short time by using industrial railroad and truck-mounted cranes. The total width of the bridge included a cantilevered catwalk 3 ft 3 in. wide on each side and a roadway of 24-ft 7-in. width. The two main trusses were spaced 16 ft 9 in. from center to center. After the concrete roadway slabs were secured to the structure, the bridge was opened to traffic and has served heavy military and civilian requirements ever since.

Parallel Concrete Arches Over Neckar River

The second bridge to be discussed herein posed quite a different problem. The superhighway from Stuttgart to Munich crosses the Neckar River, a road and a double-track railroad line. Two parallel bridges, consisting of reinforced concrete three-point arches, had carried the two roadways across the river. The two stream openings in each of the bridges had been destroyed and great pieces of debris were lying in the channel. The broken sections of the northernmost bridge had been used to serve as the foundation for an emergency span of timber with I-beam sections for crossbeams and stringers.

When the writer inspected this emergency structure, it was a remarkable sight. The destroyed bridge had settled in the water to a considerable depth, as shown in an accompanying illustration. The deck had sunk so far that another bridge had been built on top of it to keep the roadway in an approximately level position. The timber supports, which leaned about 30 deg from the vertical, had been shored up by other timbers precariously set on the slanting bridge deck of the destroyed span. Near the eastern abutment, the crossbeam was supported on a block of concrete placed on a large piece of rubble. A shearing crack which all but severed the concrete from the rubble threatened to cause the collapse of the crossbeam and the rest of the bridge.

On the other side of the bridge, the timber bents had also been built on the deck of the original bridge. Close examination revealed that this deck was supported at one end in a precarious fashion by pieces of broken concrete, mostly by virtue of the friction between the pieces. The other end rested in the muck of the river bed.

It was necessary of course to close the bridge to all traffic. Fortunately, an easily accessible detour was available for use until a Bailey bridge with pile foundations had been erected to serve as a temporary structure. The clearing work had to be done quickly, as the flood period of the Neckar River was approaching and the rubble in the stream channel would obstruct the flow, thus causing scour under the abutments.

At the same time the debris of the southern bridge was removed, and piles were driven along the line of the structure to accommodate rails for a traveling crane. Clearing of the broken reinforced concrete proved a major undertaking, and some periods of high water delayed commencement of the reconstruction work. The bridge is now being erected of reinforced concrete in accordance with the original plans and on the original piers. When it is completed, the temporary Bailey bridge will be dismantled.

Like the Kaempfelbach Bridge, the Neckar River Bridge presented the problem of a one-sided arch thrust since two of the arches had collapsed. Cracks in the pavement of the remaining arch indicated that the outside supporting pier was slowly giving way, thus endangering what remained of the bridge. At the Kaempfelbach bridge this problem had been solved by the use of "tie-back" cables, but in the Neckar River structure a counterbalance mechanism was installed under the arch of the endangered span.

Since the ground was not solid, the supporting mechanism had to have a self-adjusting feature. The sagging arch was shored up by a steel column placed on the ground. Between the column and the arch a steel lever was installed so that the short arm of the lever would exert pressure on the arch from below. The pressure was created by steel weights suspended from the other arm of the lever. Settling of the column was automatically compensated for by the sinking of the weights, which would thus maintain a steady controllable supporting pressure.

Twin Continuous Plate-Girder Bridge

The third bridge to be discussed here is the twin continuous plate-girder bridge spanning the railroad yards in Karlsruhe. One of the spans had been heavily damaged, but two of the three unequal openings in the other bridge were in fair condition. As the blasting had completely obliterated the northern concrete abutment, the span had ruptured in the last opening and its end had dropped to the ground. Further damage had been done by the blasting of the south abutment which had split in the middle and was leaning dangerously. It had also been displaced from its foundation by the force of the explosion and seemed to be held up merely by the ends of the twin spans, both of which had been blown from their bearings and were leaning on it haphazardly.

German structural steel usually comes in three classes, St 37, St 44 and St 52, with an ultimate strength of 53,000, 63,000, and 74,000 psi, respectively. The plate girders of the Karlsruhe Bridge were made of St 52, the strongest of the three. Therefore a relatively small moment of inertia caused greater deflections than usual. Because of this fact and the damage to the two outside openings, the girders in the long center span were considerably deflected.

The first step in the reconstruction was the erection of temporary piers to support the sagging bridge in all three openings. Work was complicated not only by the railroad traffic underneath but also by the fact that half of another bridge was still in place under the structure, held up by temporary shoring. Abandonment of one of the twin bridges permitted parts from it to be utilized in restoring the other bridge, which was in better condition. The work centered mainly around three locations—the two abutments and the broken girders in the northern opening.

Once the temporary piers had been installed, the broken parts of the girders were cut off and the short northern end was raised to its original position. As the skew end of the bridge had been badly twisted by the explosion, the German engineers were planning to cut it off completely and to replace it with the corresponding end of the abandoned bridge. However, examination of the damaged end showed that although the girder had been badly twisted, the crossbeams, stringers and lateral braces formed a stiff cellular network which held the girder in its position.

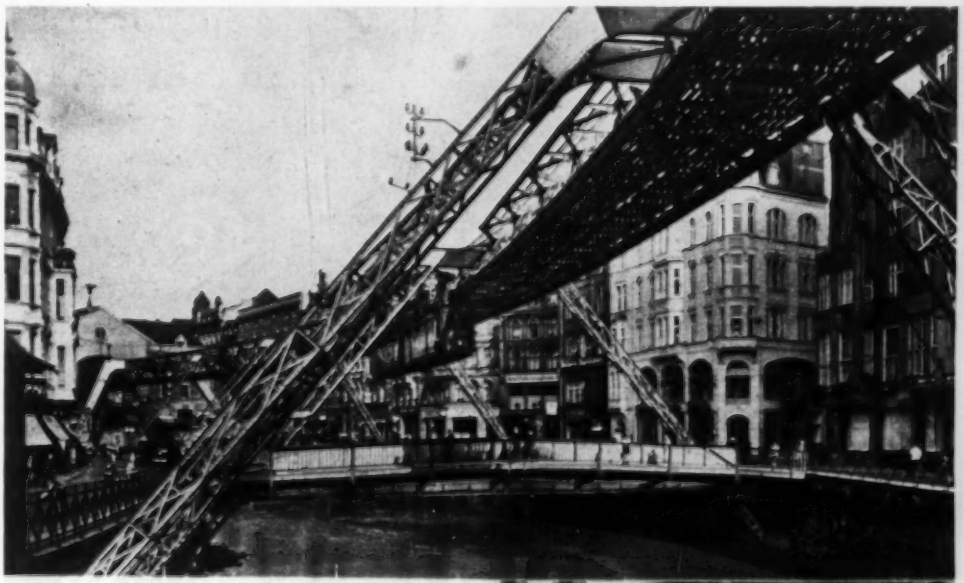
To avoid the complicated cutting and replacing job, the girder was disconnected from all braces and straightened with hydraulic presses without the application of heat. Once removed from the other members, the girder was readily brought back into shape. At the location of the rupture in the bridge, a section about 30 ft long had to be removed and replaced with a similar undamaged section. The debris of the northern abutment was removed and a new abutment was built on the old foundation. The bridge was then removed from its temporary supports and placed on the new abutment.

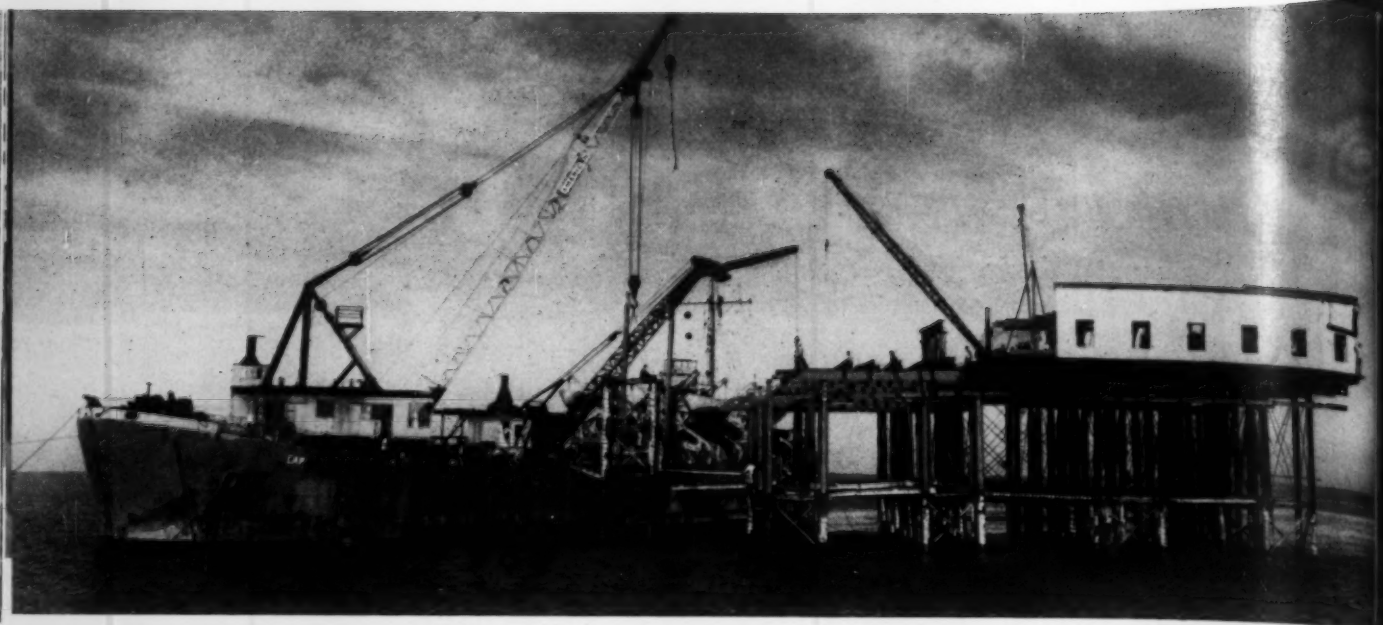
An interesting problem was presented by the southern abutment which had no reinforcing and was leaning precariously. It was not known whether the weight of the bridge alone was holding it up. As this abutment was close to one of the main railroad tracks, an attempt to get it back in position appeared worthwhile. Before the bridge was lifted off onto the temporary pier, the abutment was shored to prevent toppling. After the bridge was placed on the temporary pier, hydraulic jacks were used in an attempt to straighten the abutment but with only partial success. The abutment was then undercut and carefully rolled back until it held its original position.

The destroyed edge was patched on and the end of the steel bridge lowered to final position on new bearings. The bridge was reopened in the summer of 1947.

River Serves as Right-of-Way for Rapid Transit Railroad

ELEVATED STRUCTURE in Wuppertal, Germany, solves right-of-way problem by utilizing space above river. In this industrial city of about 400,000 inhabitants located in narrow Wupper River valley, where room for traffic arteries is at premium, 80 percent of 9-mile rapid transit system is over water and remainder over streets. Cars hang on monorails on steel structure which provides for two-way traffic. Electric motors are mounted next to wheels above rail and car itself is suspended. No superelevation of rail is needed, as centrifugal force merely causes cars to swing out on curves. No passenger fatalities have occurred during 50 years system has been in operation. Stations at frequent intervals along line, at level of car floors (left background), provide access for passengers.





PREFABRICATED GUIDE TEMPLETS and H-piles are shipped from contractor's yards at New Orleans and placed by two cranes aboard converted LST. Weighing 18 tons, 80-ft-long bents sink 15 ft into clay of Gulf bottom. Living quarters for 54-man crew take shape as construction nears halfway mark.

Steel H-Piles and Pipe Bents Support Deep-Water Drilling Platform

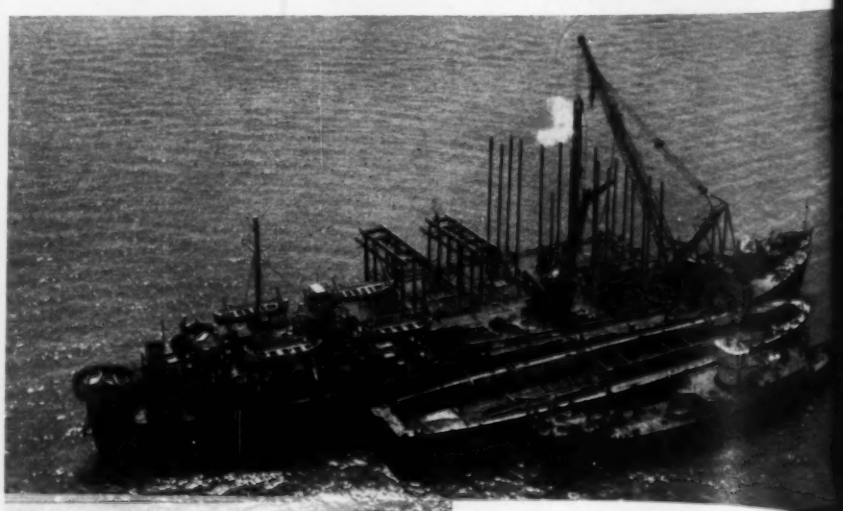
C. GLENN CAPPEL, DIRECTOR ASCE
Member of Firm, W. Horace Williams Co.,
New Orleans, La.

CONSTRUCTION of a huge stationary oil drilling island in 50 ft of hurricane-swept water 8 miles off the Louisiana Gulf coast—where 120-mph gales and driving 35-ft-high waves can be expected—set a precedent for this type of structure. Supported on 100 H-piles, the 10,000,000-lb all-welded structure will have two half-acre decks providing complete well-drilling equipment and comfortable living quarters for 54 men. Problems met in designing and constructing the drilling structure for the Humble Oil & Refining Co. are reviewed here by C. Glenn Cappel, Director ASCE, whose firm, the W. Horace Williams Co., handled the project.

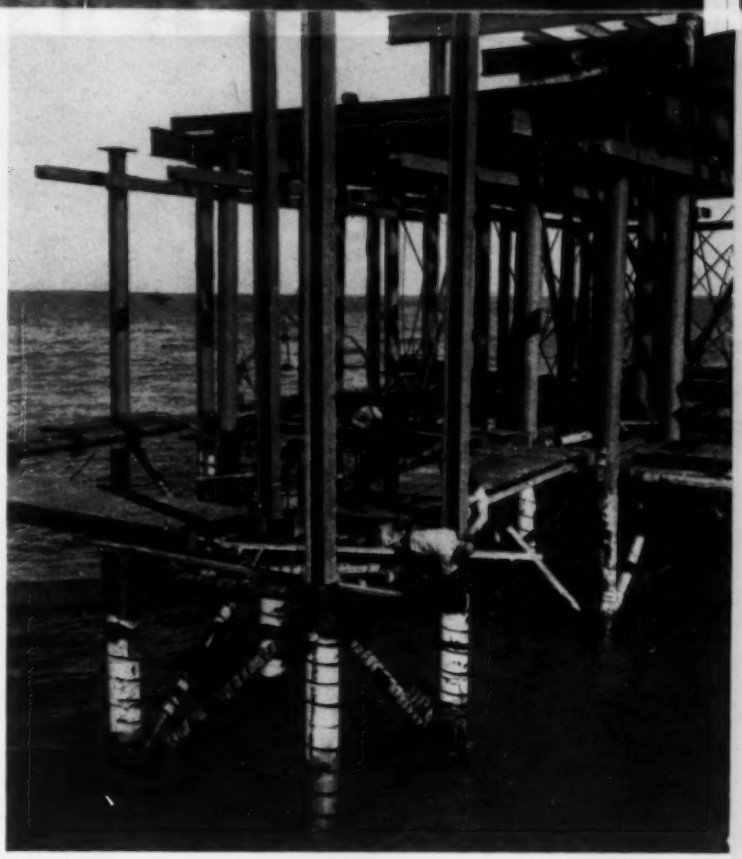
NO PART of the world seems to be immune from the probing of the drill bits of the oil companies. In fact, the search for oil goes on at an accelerated pace. The mountains, the plains, the towns and the hinterlands are being explored with increasing intenseness, and now the bottom of the ocean is receiving the attention of this most progressive and aggressive industry. In answer to the writer's recent query, "Why do oil companies explore such out-of-the-way and inaccessible areas?" an executive of one of the oil companies answered that generally wherever there is territory which is worth nothing and which is absolutely inaccessible, there oil may be found—at least there the industry tries to find oil. Possibly this unremitting search is a good thing since it serves as a constant stimulus to the ingenuity of engineers.

Exhaustive surveys of the continental shelf in the Gulf of Mexico have been going on for a number of years. Scientific wildcatting was started in earnest in 1947. The Gulf bottoms are leased from the states who claim ownership. To maintain the usual level of confusion, the federal government also claims ownership. The oil companies are in the middle. In due course, the differences will probably be resolved. At any rate, the oil companies are going ahead with their explorations.

During 1946, The Humble Oil & Refining Co. asked for proposals and designs for certain structures to be built off the Louisiana coast in the Gulf of Mexico in 50 to 60 ft of water.



SMALLER PLATFORM near Tigre Pass, about 25 miles from Grand Isle drilling platform, is constructed by same converted LST shown above. Steel deck platform 50 × 150 ft is supported by 40-ft H-piles driven 150 to 185 ft into sedimentary blue clay of Gulf floor.



TOWER BENTS consisting of 16-in. pipes on 10-ft centers serve as lateral support for 280-ft-long 10-in. H-piles. Here welder tacks guide plates on templet before pile is lowered. Platform atop test pile in left background holds core test rig for obtaining soil samples.

The proposal of the W. Horace Williams Co. was considered best by Humble, so appropriate contracts were entered into. The approach of the W. Horace Williams Co. to the problem was based on previous experience in the building of offshore drilling platforms and subsequent studies.

Design Features Underwater Bracing

Considerations affecting the design included: Depth of water, fetch and exposure, bottom characteristics, normal wave action, hurricane wave action, hurricane winds, littoral currents, load concentrations, possible and probable cumulation of forces, rigidity under drilling conditions, areas required for machinery and supply layout, and crew quarters.

Without bracing, the unsupported length of piles in 50 ft of water would be about 70 ft, i.e., 10 ft above water and 10 ft below the Gulf bottom. To reduce the slenderness ratio of the supporting piles, it was considered desirable to resort to an old, well-proved and much-used principle of underwater bracing. The unit of construction was based on a four-pile group. The piles in the group had to be spaced so that each could give away its load to the ground without overlapping of bulbs of influence. The tower bent or braced unit had to have sufficient base for stability and sufficient depth when acting as a vertical truss to withstand the horizontal loads.

These considerations resulted in a tower bent or unit consisting of four 16-in. pipes spaced 10 ft on centers with a length 30 ft greater than the depth of the water. This design allows the toe of the tower-bent unit to penetrate the bottom to a depth of about 20 ft and the top to be finished off at about El. +10, which is above normal wave wash. The 20-ft penetration provides confined support for the piles below the point of contraflexure. The 16-in. pipe was braced with 6-in. pipe on 10-ft centers with diagonals of 6-in. pipe, both vertically and horizontally, thus forming a rectangular tower 10 ft square and 80 ft long. The piles used are 10-in. 57-lb H-piles, driven through the 16-in. pipe of the tower bent and designed to carry vertical loads.

Factors Influencing Hurricane Waves

The height of hurricane waves as well as the horizontal forces exerted by them is directly related to the depth of water and the fetch—that distance over which the wind has free play on the water. It was estimated that the wave height in water 50 to 60 ft deep with a fetch of 100 miles or more could reach 32 ft, i.e., from El. +24 to −8. Considering probable plus tides, it was deemed that an elevation of +30 would put the deck above wave action.

Above the tower bent, the piles are encased in a light-gage pipe in order to offer a circular surface to wave forces and also to provide protection against corrosion. The tower-bent units are braced to each other at El. +10 and the whole structure is trussed with sway rods from the braces to the caps at El. +30. It was felt that this arrangement would offer the least amount of structural surface to the wave forces and provide maximum strength and rigidity. Such bracing has the effect of portaling at El. +10, which with fixity in the bottom gives the condition of a structure fixed at one end and guided at the other in its support of horizontal loads.

Borings showed clay in varying degrees of solidification down to El. −250 where sand of undetermined depth was encountered. Our calculations, based on the ability of a pile to give away its load and the ability of the soil to support the load, indicated that a pile penetration of 134 ft would be sufficient to withstand any expected load without objectionable settlement. However, because of the importance of the structure, the piles were designed for a maximum penetration of 200 ft, thus making their over-all length 280 ft. Actually, they were driven to varying penetrations of from 154 to 200 ft.

Each pile was made up of prefabricated sections—one of 120 ft and three of 53 ft 4 in. Bolted splices were used, supplemented by welding in the field. Splices were prefabricated and match marked to assure close fitting in the field. As far

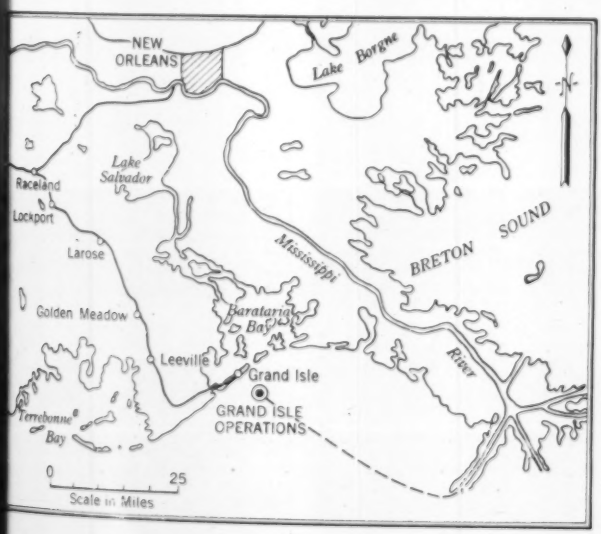


FIG. 1. ALL-WELDED drilling platform is located 7 miles from Grand Isle, long narrow strip of oak-studded sand some 45 miles south of New Orleans, La.

CONTRACTOR'S FABRICATING YARDS at New Orleans serve as center for assembling materials and equipment for shipping via channel and Mississippi River to Humble Oil Company's drilling operations off Louisiana coast. (See Fig. 1.) Maximum amount of prefabricating is done at yard to hold working time at site to minimum.

as practicable, all prefabrication was done ashore with a view to holding working time at the site to a minimum.

The equipment required for most economical and safe operation was the subject of careful planning. Because of previous unsatisfactory experience with inland-type floating equipment on such offshore work, The W. Horace Williams Co. determined to provide sea-going equipment.

Cranes and Other Equipment Provided

The company's studies resulted in the selection of an LST as the major construction vessel with LSM's for supply. In addition, personnel boats and two tugs were required—one tug to stand by the construction vessels and one to tow the supply barges.

The LST is equipped with one American Hoist & Derrick Co. revolver crane of 50-ton capacity at 60 ft, and one smaller Whirley crane with a capacity of 15 tons at 40 ft—both steam driven. The 50-ton rig sets the tower bent units and drives the piles; the 15-ton rig sets the pile sections; and later both rigs set the superstructure. On the large double-deck structures, a small caterpillar crane was set on top after the structure had progressed to the point where there was sufficient deck space for its operation. As all-welded construction is used, many welding machines and other small equipment are needed.

Because of the lack of authentic data on just what forces such a structure will be called upon to withstand, the design premises will be controversial for some time to come. However, it is believed that the design principles are conservative. Of course, the forces that come into play vary rapidly with the depth of the water, the fetch, etc., so that each location should be analyzed and the design fitted to the specific conditions encountered, within the limits of practical operations.

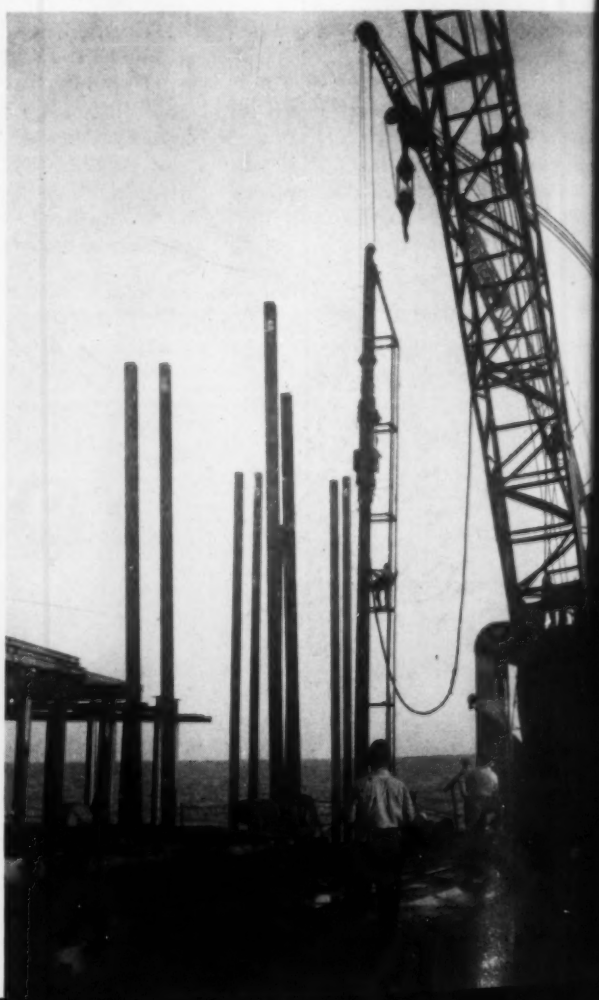
Final Design of Structure

The final design by which Humble Oil & Refining Company's Grand Isle No. 1 structure was built is as follows: The location is 7 miles south of Grand Isle, La., in about 50 ft of water. To the north the fetch is 7 miles; to the east, 30 miles; to the south, Yucatan; and to the west, Texas. The angle of exposure is about 180 deg. There are two decks, one at El. +33 and one at +48. The structure, which is 110 ft wide by 206 ft long, is placed broadside to the prevailing winds, and is supported by 25 tower-bent units and 100 10-in. 57-lb H-piles, ranging from 230 to 280 ft long. The design is so arranged that up to 14 wells can be drilled from the one location, but the actual number of wells drilled will be governed by results as drilling progresses. Adequate crew quarters are provided for the maximum force required.

The most economical answer to the problem of designing offshore structures of this type is yet to be found. It is believed that the structure here described is on the right track and that improvements in design and operation will come with further experience.

Recently the writer was asked by S. W. Oberg, M. ASCE, chief civil engineer of the Humble Oil & Refining Co., what the writer's firm would do when it was necessary to go out into water 400 to 500 ft deep. The writer replied, "I don't know now, but we will try to have the answer by the time Humble wants to go to 'sea' further."

The work here described was done under the direction of Mr. Oberg, chief civil engineer, and J. S. Toler, assistant division civil engineer, of the Humble Oil & Refining Co. The structure was designed by the writer and built under the supervision of R. E. Gosa, Assoc. M. ASCE, both members of the firm of W. Horace Williams Co., Inc.



H-PILES of prefabricated sections ranging in lengths up to 280 ft are driven to penetrations of 154 to 200 ft by 0-R Vulcan hammer. Leads are handled by American Hoist & Derrick Co. crane with 50-ton capacity at 60 ft.

Engineers' Notebook

s Field CBR Test Adaptable to Granular Subgrades and Bases?

HARRY R. CEDERGREN, Assoc. M. ASCE
Senior Engineer, U.S. Corps of Engineers, Portland, Ore.

ANY ENGINEERS throughout e world are familiar with the small-ale laboratory penetration test de-loped by the California Division of ighways for the design of flexible vements. This test, known as the alifornia Bearing Ratio, or CBR st, evaluates the relative bearing rength of soils and base materials in rms of the load carried on a steel ston of standard size penetrating e soil at a given rate. The original st is performed on soil compacted in cylindrical mold; however a modi-d test can be performed in the field determine the strength *in situ* of bgrades and bases.

When used in the field to test anular materials, some difficulty s been encountered in obtaining asonable and consistent bearing tios, and the test has been labeled some engineers as unreliable. A ticism frequently heard is that the ge diameter of coarse aggregates as mpared with the diameter of the netration piston (area of penetra-n piston is 3 sq in.) causes an in-ease in load supported by the piston th a resulting increase in the bearing io obtained. However, an exami-tion of questionable data obtained testing coarse-grained materials nost invariably shows bearing ra-s that are not too high, *but too low!* Detailed examination of the data kes it evident that some factor or mbination of factors, other than increased distribution in load ributed to the presence of large gregates, has a very significant uence on the bearing ratios. In ne instances unreasonably high ring ratios may be caused by the sence of large aggregates; how-r practically all questionable field R results that have been examined the writer can be attributed to proper seating of the penetration ton. Unless the piston is in inti-te contact with an undisturbed surface over the full contact area, representative bearing ratios will not be obtained.

In testing sandy or rocky materials in the field, it is practically impossible to obtain a perfectly smooth surface because of the coarse soil grains present. Under these conditions a thin layer of clean sand is sometimes used to fill the uneven space between the piston and the surface being tested, as shown in Fig. 1 (*a*). When this method is used, any yielding within the sand layer will allow stress to concentrate at high points and rupture the soil before the full strength is mobilized. To avoid this error, the seating medium should be capable of molding to the exact contour of the soil surface, and must be capable of hardening sufficiently to insure no failure within itself, as illustrated in Fig. 1 (*b*). Plaster of paris can be used for this purpose but it must be allowed sufficient setting time to prevent consolidation or rupture under the applied loads.

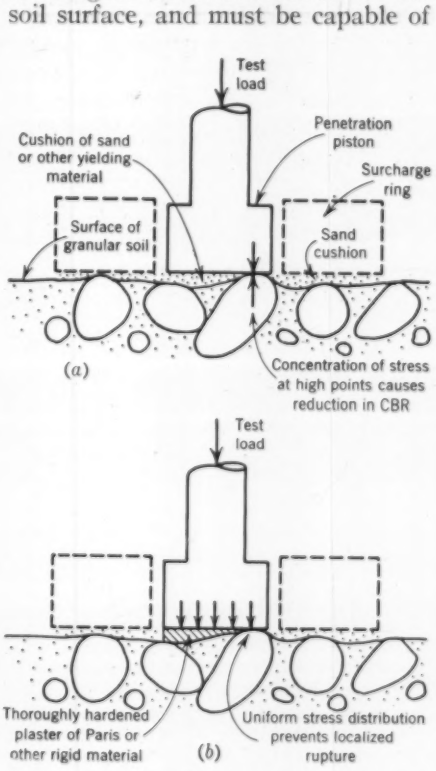

Test load
Penetration piston
Cushion of sand or other yielding material
Surcharge ring
Surface of granular soil
Sand cushion
(a)
Concentration of stress at high points causes reduction in CBR
Test load
Thoroughly hardened plaster of Paris or other rigid material
(b)
Uniform stress distribution prevents localized rupture

FIG. 1. DIAGRAMS SHOW INFLUENCE of seating method on CBR of granular materials. (*a*) Stress concentrations caused by non-rigid seating, and (*b*) uniform stress insured by rigid seating.

The required setting time for plaster of paris cannot always be judged by the apparent strength indicated, for example, by breaking with the fingers, and is greater for high bearing tests than for low bearing tests. The minimum time of set that will insure adequately hardened seating for the conditions on any job can be easily determined by trial tests on an unyielding surface. Plaster caps are placed between the penetration piston and a rigid surface, and load applied after variable setting times. A few tests will readily establish the time required. Under a variety of conditions the writer has found that 20 minutes has been adequate, but more or less time may be required for different conditions.

Not only must an adequate seating medium be used, but all loose material must be removed and the test made on a truly undisturbed surface. Pointed bars, screwdrivers, or other pointed tools should be used for the removal of loosened material. Paint brushes are helpful in the final clean-up of a surface. This part of the testing procedure should be given careful attention, as the tests will be worthless if the penetration piston is not seated directly on the undisturbed surface of the material tested. A layer of disturbed material can completely nullify the test results. The following example illustrates the importance of proper seating of the penetration piston on granular materials.

The in-place bearing ratios of a sand subbase and a crushed-rock base course on an airfield pavement that had been subjected to a known amount of traffic was to be determined by the field CBR test. The sand had performed like a material with a CBR of about 70 percent, and the crushed rock like a material with a CBR of at least 150 percent. A series of about 40 field CBR tests was completed in test pits excavated into both materials, moderate care being exercised in preparing the surface and seating the piston.

These tests gave bearing ratios averaging 20 to 30 percent for the sand and 30 to 80 percent for the crushed rock. These values were known to be considerably lower than the real strengths of the materials; hence an investigation was made in an effort to determine the cause of the low values obtained. It was known that values secured by the field test can be expected to be slightly lower than those obtained in the standard laboratory test because of the confining action of the mold in the laboratory test. However, the extreme differences were believed due to testing technique. A careful study of the test procedure proved that thorough brushing of the surface to remove loose particles (which was judged by the operator to be sufficient to insure a good test surface) did not remove all material disturbed in the excavation of the test pits in the crushed rock. It was found necessary to use pointed tools to remove all material affected by the excavation process.

Further study of the testing procedure proved that the plaster of paris cap used in the initial tests, although allowed about 10 minutes for hardening, did not have sufficient strength to resist deformation under the high pressures used. A series of tests indicated that 20 minutes' setting time was required to insure an adequately hardened seating cap.

Having established these two weaknesses in the original testing procedure, a second series of tests was performed on the sand and the crushed stone, using care in removing all loosened material and allowing at least 20 minutes for the cap to harden. Immediately the bearing ratios jumped to between 60 and 80 percent for the sand and to between 150 and 250 percent for the crushed rock! These tests were conclusive proof that representative bearing ratios cannot be obtained by the field CBR test unless proper precautions are taken to insure intimate contact of the piston with an undisturbed surface of the material tested. Similar experience with other granular materials substantiates this conclusion.

The field CBR test should not be discarded as a means of evaluating the in-place bearing ratio of granular subgrades and bases for flexible pavements on a particular job until it has been given a fair trial. Some scattering of results can be expected because of variations in gradation and density from point to point. To compensate for scattering, the test should be made in groups of 5 to 10 tests on each depth tested, obviously wild values discarded, and the average of the acceptable tests taken as the bearing ratio of the layer tested. When used with a little judgment, this test can be a valuable asset to the airport or highway engineer.

Proper Compaction Eliminates Curing Period in Constructing Fills

WILLIAM H. ROWAN, M. ASCE, and WALTER W. GRAHAM

Respectively Associate Professor of Civil Engineering and Associate Professor of Applied Mathematics, Vanderbilt University, Nashville, Tenn.

YEARS AGO fills were usually built and compacted without regard to moisture content or to the ultimate compaction desired. Under such construction conditions it was necessary to allow the fill to undergo a curing period. For example, a highway fill would be covered with a temporary road surface and allowed to come to its ultimate compaction under weather and traffic.

Much work has been done in an effort to eliminate the necessity for a curing period. Probably the most popular method devised is that of Proctor,[1] which has proved its worth on a great number of engineering projects. The Proctor compaction method is supposed to give without delay the same soil density that would be achieved only after a long waiting period by the older system of letting nature do the job.

It seemed advisable to study the soil mechanics of settlement to determine why the Proctor process is so successful. If a soil to which moisture has been added is placed in a mold so as to just fill the mold and if the soil is then dried out, the soil may shrink or it may not. Whether or not a volume change takes place depends on two prime factors—type of soil and moisture content. Experiments show that the percentage of volume change is equal to the moisture content minus the shrinkage limit, with the result thus obtained multiplied by the shrinkage ratio.

If the soil mass is allowed to cure in the field under traffic and weather, is it not reasonable to suppose that as the soil becomes alternately wet and dry through changes in the weather, and as cracks are formed and filled, the earth fill ultimately will obtain a density equivalent to that which the same soil would reach if put through the same process in a mold?

SOILS ARE COMPACTED to increase their specific weight and thus their stability. Compaction expels air from the soil pores and decreases the thickness of the water film causing the soil mass to have more cohesion, which results in an increase in the mechanical bond. The presence of air in the pores is harmful because if the fill is wholly or partially under water, the air dissolves in the water which then fills the pores, decreasing cohesion and softening the fill.

Since construction based on Proctor's method is satisfactory under actual field conditions, the Proctor test must give a density close to the density of a fill cured under weather and traffic. This leads to the assumption that the Proctor density will equal the density of a cured fill, which logically should be that calculated from the shrinkage ratio.

It is believed that the following method of calculating the density of soils, which is in keeping with the theory previously presented, might prove interesting and profitable to the engineering profession. A number of tests have been tabulated which indicate that the calculated results agree fairly closely with those secured from the actual Proctor test.

Because the Proctor density is obtained from samples which pass the U.S. No. 4 screen and the shrinkage ratio is obtained from samples which pass the U.S. No. 40 screen, it is necessary to make a conversion so as to relate the two. For convenience, let us say that from any sample of soil that part which passes the U.S. No. 4 screen shall be called A and that part which passes the U.S. No. 40 screen only, shall be called B. Obviously B is contained in A, is only a part of A, or at most is equal to A.

Since the shrinkage ratio is the apparent specific gravity, if B is 100

[1] R. R. Proctor, M. ASCE. See *Engineering News-Record*, Vol. 111, July–December, 1933.

percent of the original sample the weight per cubic foot can be obtained by multiplying the shrinkage ratio by 62.5. If A is not 100 percent of the original sample, it can be considered as such because material which does not pass the U.S. No. 4 screen is not considered in the Proctor test. Then if B is only a part of A we proceed as follows. Multiply the shrinkage ratio by 62.5 to get the weight per cubic foot of B. Call this number C, which is in pounds. Divide C by B/A and the result D will be equal to the weight of A necessary to obtain exactly 1 cu ft of B material when compacted. If the specific gravity of A which does not include B is S, the volume of this excess material is $\frac{D - C}{62.5S}$. The total volume of D is $1 + \frac{D - C}{62.5S}$. The calculated density is

$$\frac{D}{1 + \frac{D - C}{62.5S}}$$

The value of S can be obtained from actual test by determining the specific gravity of a material passing a U.S. No. 4 screen and retained on a U.S. No. 40 screen. The value of S used in this work is the approximate specific gravity as calculated from the shrinkage limit and the shrinkage ratio. Since the calculated value will vary somewhat from the specific gravity as actually determined, it is well to show that the effect which an error in specific gravity has on the final result will be small for even a wide variation in the specific gravity. If a specific gravity of 2.5 is used for this more coarse material, the calculated density is not far from right, as may be seen from the following examples.

Given a sample for which the following data are known:

Shrinkage ratio = 1.67; A = 100 percent; B = 80.5 percent; and S = 2.5. The calculations follow:

$C = 62.5 \times 1.67 = 104.5$

$D = C \div B/A = 104.5 \div 0.805 = 129.5$

Density (calculated) =

$$\frac{129.5}{1 + \frac{129.5 - 104.5}{62.5 \times 2.5}} = 111.6 \text{ lb per cu ft}$$

If the value of S is taken as 2.35 instead of 2.5, the calculated density is 110.7 lb per cu ft, and if S is given a value of 2.65, the calculated density in the previous example is 112.5 lb per cu ft. Here is a difference in density of less than 2 lb per cu ft from the extreme low of 2.35 to the high of 2.65. It is not likely that the calculated specific gravity would vary as much from the true apparent specific gravity as in the above example, so that use of the approximate value should give reliable results in any case.

Since this method of calculating density at optimum moisture content gives results closely approximating those obtained by the Proctor method, several carefully controlled experiments were run and the results compared with the calculated values based on S = approximate specific gravity. These results are given in Table I.

Consider the quantity of moisture that should be in the soil when field compaction is begun. Since the shrinkage limit represents the percentage of water which would just fill the voids in the U.S. No. 40 screen material, if the moisture content is greater than this percentage it would be impossible to reach either the Proctor density or the calculated density without first removing by evaporation or work the moisture in excess of the shrinkage limit. The product of the shrinkage limit and the percentage of the sample passing the U.S. No. 40 screen gives the percentage of moisture that should not be exceeded, if the soil is to be brought to the proper density with a minimum amount of work.

The calculated percentage of moisture is usually from 1 to 5 percent greater than the Proctor optimum moisture figure and, with a reduction of 3 percent, can be safely used as the moisture content at which to compact the fill. When a fill is compacted at this moisture content, there is enough moisture to give sufficient lubrication to the soil particles so that it is not necessary to do an excessive amount of work on the fill to obtain the compaction desired.

The shrinkage limit and the shrinkage ratio are a part of the indicator tests normally furnished with a soil survey. Without further testing, all the information is available for the calculation of density. The number of man-hours required to run the tests necessary for obtaining the calculated density of a number of samples is only a fractional part of the man-hours required to obtain the density of the same soil samples by the impact method. Since the results obtained appear to be just as accurate, this method of calculating is believed to be advantageous.

TABLE I. TEST DATA SHEET FOR SOIL SAMPLES

Gradation Total % Passing	1	2	3	4	5	6	7	8	9	10
4-mesh	100.0	100.0	100.0	100.0	100.0	100.0				100.0
10-mesh	90.9	87.8	96.3	92.5	90.8	97.0	100.0			98.3
35-mesh	80.5	68.8	88.0	85.3	81.7	91.1	97.6	100.0	100.0	94.5
80-mesh	75.5	56.3	83.8	78.3	77.0	86.5	93.6	97.5	87.1	90.0
200-mesh	69.8	43.4	78.3	73.0	72.3	82.8	89.6	85.1	80.0	78.5
Silt & clay	67.0	37.4	76.7	68.0	70.4	81.0	88.0	64.0	78.8	76.5
Clay	13.2	13.7	26.3	18.5	16.4	25.6	59.0	24.0	50.0	32.1
Soil Constants										
Lower liquid limit	39.1	21.1	44.3	32.2	27.3	40.7	73.8	26.3	49.2	39.5
Lower plastic limit	22.2	16.2	26.7	24.3	23.5	23.9	34.0	23.1	27.6	27.6
Plasticity index	16.9	4.9	17.6	7.9	3.8	16.8	39.8	3.2	21.6	11.9
Field moisture equivalent	22.6	16.2	27.3	22.7	21.7	22.4	33.5	19.8	33.0	20.3
Shrinkage limit	22.3	17.8	21.5	21.2	22.7	20.9	26.2	18.5	25.4	31.0
Shrinkage ratio	1.67	1.81	1.68	1.65	1.62	1.71	1.50	1.79	1.69	1.62
Approximate specific gravity	2.66	2.66	2.63	2.54	2.56	2.65	2.55	2.66	2.42	2.65
Optimum moisture	16	9.5	18	14.5	14.7	17.7	22.0	12.0	23.2	21.6
Proctor density	111	119.5	105	110	111	108	96	112	104	104
Calculated optimum moisture	15	9.5	16	15	15.5	17	22.5	15.5	22.5	26
Calculated density	112	125	110	108.5	108.5	110	95	112	106	104

...THE READERS Write

Advocates Licensing as Aid in Raising Professional Standards

TO THE EDITOR: Bouquets to Professor Kellogg for his letter on the need for new professional standards, in the April issue of CIVIL ENGINEERING. We younger members, particularly, appreciate a realization by older members of the fact that the standards of our profession need some progressive rebuilding.

But is the American Society of Civil Engineers the organization through which our standards are to be raised? It is true that we could learn much from the American Medical Association, but the two organizations have almost nothing in common, except that both have a code of ethics and provide technical information to their members. Although all members of the American Medical Association have successfully passed their state board examinations and are recognized legally as doctors, it is questionable whether we could limit membership in the American Society of Civil Engineers to those engineers recognized legally as engineers by reason of state licensing laws?

Most of us agree, in principle at least, that we must show some progress in improving our standards along the lines that Professor Kellogg has indicated. First, civil engineering must be made a profession, legalized by licensing laws, so the title "engineer" will have some significance and will keep an air-compressor operator, for example, from calling himself an "engineer." The eventual result would naturally educate the layman in what constitutes engineering. Few people are unfamiliar with the term "doctor" or lawyer," but how often have you been asked by the layman, "Pardon my ignorance, but just what does a civil engineer do?" No profession, however, directly or indirectly lends itself to publicity of more general interest than civil engineering. Man-made structures have always aroused curiosity in people as evidenced for example, by the number who have seen and marveled at Hoover Dam.

Second, college courses in engineering should be reorganized along the lines that Professor Kellogg has indicated, with the profession keeping close supervision over engineering college training and maintaining an accrediting system similar to that in the medical profession.

Finally, and certainly most important to every civil engineer at the present time, is the economic status of the profession in general. Profession Kellogg says "before education can contribute its greatest potential, the profession must offer greater rewards." With veterans clamoring for an engineering education, the possibility that the demand will exceed the supply is nil. Therefore, it seems impossible to increase the reward until the standards are raised, paradoxical as this may seem in comparison with the development of other professions.

We must, through some progressive organization of professional (licensed) civil engineers, raise our standards, and the economic condition of the profession will eventually be adjusted.

CHARLES S. MOORE, Jun. ASCE
Oakland, Calif.

Advises Financing of New Construction by Long-Term Security Issues to Retire War Bonds

TO THE EDITOR: Any analysis of general financial problems in this country must necessarily take into account the existence of a large public debt. The securities issued to finance wartime deficits were purchased by large numbers of investors. They are now considered as assets by their owners either for security reasons or for the general conduct of business operations.

Industrial, commercial, investment, and insurance activities of the country have expanded and are geared to the existence and use of these securities. Reduction of the gross volume of bonds in use probably cannot be brought about without a loss of trade volume which is not desirable. Construction of capital improvements by long-term security issues appears to be the only method by which obligations representing actual physical assets could be substituted for the war bonds which were issued to finance expendable items during an emergency and have no real asset backing.

Provided long-term credits can be made available at reasonably low interest or dividend rates, a vast amount of construction work will be feasible. When the war-generated shortages of labor and material start easing off, the need for this construction to maintain a high level of business activity will become apparent.

Improvement and replacement of housing as well as expansion of the number of dwelling units is the largest single item of desirable construction. It has been estimated that upwards of one hundred billion dollars will be required for a minimum solution of this problem. For long-term financing, neighborhood protection and construction of a substantial character resulting in low maintenance cost and stable values will be essential.

There is also great need for expansion and improvement in the fields of transportation, sanitation, power generation and distribution. Many industrial processes can utilize improved and more efficient plant and equipment. They can be operated more economically if such modern facilities are provided.

If at all possible, planning of much of this work should be done ahead of the time of actual need to prevent a disastrous slump. Required legislation and blueprints do not grow overnight. Intelligent planning should be arranged to allow time to study annual costs as well as first costs. In an era in which labor leadership is committed to high pay, short hours, and a medium speed on performance, first costs will probably remain at a high level. Maintenance costs will also be high unless reduced by use of better types of equipment and construction. For the latter, first costs will be even higher. However, total annual costs for many items can be brought to approximately prewar levels by use of sturdier and more permanent materials, and provision for allowing periodic replacement of wearable parts in the initial design. In no other way than by the use of more capital for more efficient and longer lasting articles can the standard of living be maintained and improved at present labor efficiency.

National and world problems seem somewhat overwhelming at the moment and people in general are wondering if production of consumer items will ever catch up. Experience indicates that when this does occur it will come about very suddenly. Unless broad general plans are now considered and made workable, the country may be caught un-

prepared. Expenditure of funds for advance planning should be encouraged by direct governmental assistance and by suitable income-tax rules which will allow classification of planning expenditures as current operating expense. Engineers and industrialists through their national associations should initiate movements to bring about such adequate and sound planning.

A real endeavor should be made to direct the planning toward improvement of labor's working and living conditions. Introduction of more efficient equipment and plant for governmental, industrial, commercial, farming activities and improvement in housing will all be required to keep the productive processes operating at full capacity and to keep all available labor gainfully employed.

GEORGE O. CONSOER, M. ASCE
Consulting Engineer
Chicago, Ill.

New Transportation System Planned for Sao Paulo

TO THE EDITOR: Engineers may be interested to know that Sao Paulo, Brazil, is to have a modern high-speed transportation system. The project is vitally needed, because Sao Paulo is probably the fastest growing municipality in the world, with a present population of 2,000,000. Its area of 602.7 sq. miles is nearly double that of the five boroughs that comprise New York City. The city is 47.3 miles long in a southwest-northeast direction, and northwest-southeast it extends 30.8 miles.

Ralph Wesley Jones, Philadelphia consultant, has been in Sao Paulo, Brazil, since January 1948, as consulting engineer and project engineer in charge of engineering and economic studies and report for the municipal government's high-speed transportation system. Mr. Jones has a background of 30 years of experience in transportation, public utility and general engineering, management, reports, and construction.

Much of this extensive area is not densly populated, because of the Brazilian type of one-story house. Paradoxically, many people use less home space per person than in America. Some idea of the city's rate of growth may be obtained from the fact that six buildings—apartment, office, factory, home, etc.—are completed every hour of the 48-hour builders' week.

Mass transportation now totals 700 million riders annually. Handling such traffic with 580 buses and 588 trolley cars is quite a feat, especially when the ancient trolleys include 62 open trailers, 406 open cars and 9 workmen's (second class) cars. Under discussion for the past 23 years, the transportation project is now moving forward aggressively under Governor Ademar de Barros, who has built extensive modern highways, hospitals and educational institutions.

The greatest difficulties in planning the project are caused by the typically Brazilian type of rugged terrain, one of the most uneven to be found in any city. There is a range in elevation from the lowest to the highest point of about 374 ft, but that does not illustrate the difficulty of traversing steep ridges that radiate in all directions from the old "downtown" section. Even the ridges are uneven in elevation.

Study and design problems are further increased by the extremely irregular pattern of the narrow, winding and almost precipitous streets. Nomenclature for the streets and avenues has followed an arrangement by which a new name may be used for every few blocks, the names honoring some figure or date in history, such as, Rua Vinte e Quatro de Maio, Avenida Nove de Julho, Avenida Dr. Arnaldo V. Carvalho, and so on.

RALPH W. JONES, M. ASCE
Sao Paulo, Brazil

Recalls Variant of Method for Design of Flat Slabs

DEAR SIR: Mr. Floris' article proposing more exact analysis for continuous beams over flat supports, in the May issue, brings to mind the writer's adoption about 23 years ago of a variant of his method for use in the Lackawanna Railroad office in the design of flat-slab viaducts to carry railroad loading.

Initially this method was used to check the moments obtained by figuring spans with knife-edge supports at the column centers continuous between expansion joints, with locomotive concentrations spotted to yield maximum moments (positive and negative) at end supports and spans and intermediate supports and spans, respectively. These moments were then modified by the factor obtained from the ratio of clear span length between column capitals to center-to-center spans, or by the subtraction from the negative moment obtained at the center, of the shear times the distance from the center to the face of the column capital. Since the column capital diameter in flat-slab design is generally 0.225 of the span length, it is an appreciable width; for 25-ft center-to-center column spans this width amounts to 5.62 ft.

The writer decided to figure the moments for alternate long and short spans of $19\frac{1}{2}$ and $5\frac{1}{2}$ ft, subject to the locomotive loading previously referred to. The variation from Mr. Floris' method, however, was that the short spans over the column, since they were considered not subject to deflection, were considered unloaded. It was found that this method gave somewhat lower moments than either of the other two methods used, and from then on it was more generally used than the center-to-center span lengths.

The writer doubts whether beams over piers would have a negative (upward) deflection much beyond the edges supporting the beams, particularly for wide piers. At any rate, it is on the side of safety to neglect the upward pressure.

MEYER HIRSCHTHAL, M. ASCE
Concrete Engineer, Delaware, Lackawanna & Western Railroad Co.
Hoboken, N.J.

Identity of Figure on ASCE Certificate Is Suggested

Based on an inquiry from D. R. W. Wager-Smith, a member from Silver City, N.Mex., the identity of the figure on the ASCE membership certificate was sought in an item published in the March 1948 issue of "Civil Engineering" (page 55). Research efforts at Society Headquarters indicate that old pictures of Jupiter were used as the model for the engraving. Two other suggestions received from members are published here.—Editor.

DEAR SIR: With regard to the item on the identity of the figure on the ASCE membership certificate, in the March issue, may I suggest that the gentleman pictured represents Archimedes, the Greek mathematician, discoverer of the law of the lever, and father of physics and the sciences? The nebulous background represents the later developments of the sciences he fathered. In the picture he is performing a test demonstrating beam strength.

CHARLES W. DOHN, Jun. ASCE
Glendale, N.Y.

DEAR SIR: The gentleman on the ASCE membership certificate, referred to in the March issue, is the twin brother of the gentleman who has adorned the cover of *The Atlantic Monthly*.

LEON G. CUTLER, Assoc. M. ASCE
New York, N.Y.

SOCIETY NEWS

EDITORIAL:

Why Join the ASCE?

EFFORTS TO ENROLL qualified civil engineers in ASCE, under way in the Kentucky Section, serve to point up two things: (1) Some Sections are acting promptly on President R. E. Dougherty's suggestion that "Local Sections make strenuous efforts to increase the Society's membership by interesting and inviting applications from the leading engineers in their territories" (see "Civil Engineering" for February 1948, page 52, and March 1948, page 53), and (2) many present members of the Society are finding in their answers to prospective members' inquiries a "refresher course" in the advantages offered by affiliation with ASCE.

The Kentucky Section officers have anticipated some non-members may ask: "Why join the ASCE?" To assist members in answering, each has been furnished with a statement under a heading which asks that very question. Some of the answers emphasized are:

"The outstanding ASCE contribution to engineering knowledge and literature has not been the result of unorganized or individualistic action, but the direct result of cooperative action by the foremost engineers of the country—extending over a period of almost a century.

"No professional engineer should evade the obligation of contributing to the advancement of his group. His professional progress is made possible by the utilization of the fund of knowledge built up by his forebears, and he is obligated to add to it according to his ability."

Asserting that "non-affiliation with at least one good professional society seems to indicate only indifference and a lack of professional consciousness," the statement emphasizes the following fields in which the ASCE has been particularly effective:

"To encourage and perfect discoveries in basic and applied science and to bring these discoveries to all members of the profession, it has published technical papers and discussions.

"To stimulate professional activity at the local level, it has created and supported local sections.

"To afford the beginnings of professional associations in universities and colleges, it has established and encouraged student chapters.

"To advance the economic standing of the profession, it has formulated and adopted classification and compensation schedules for civil engineering positions.

"To encourage the payment of higher salaries by employers, it has recommended adequate fees for consulting engineering services.

"To foster the professional standing of its members, it has promoted national registration laws.

"To improve engineering education standards, it has cooperated with other national engineering societies in the accrediting of engineering curricula.

"To free its members from enforced collectivism, it has taken effective action on national labor legislation affecting the profession."

The statement points out that "in order to provide its members and the engineering profession with the foregoing benefits, the Society expended during the past year more than $2.00 for each $1.00 collected in dues," and proudly avers that "few organizations can show such returns to its members in proportion to their payments."

As a "clincher" for those non-members not aware of it, the statement points out a fact well known to those now affiliated with ASCE: "Membership in the Society gives a recognition of professional standing in a degree second to no other organization."

ASCE Past-President in China on ECA Mission

ASCE PAST-PRESIDENT Edgar M. Hastings, chief engineer of the Richmond, Fredericksburg & Potomac Railroad, is in Shanghai, China, as a member of a special survey mission to China appointed by Economic Cooperation Administrator Paul G. Hoffman. Mr. Hastings was selected as transportation representative to study and report on industrial projects to be financed by ECA.

E. M. Hastings

The great need for utilization of the engineering profession in administration of the ERP was stressed as "the surest road to peace and the best way to insure American taxpayers their money's worth" by ASCE Executive Secretary William N. Carey, recently in an address before the Pittsburgh Chamber of Commerce (see May issue, pp. 50–51).

Roger D. Lapham, chief of ECA's special mission to China, headed the group of which Mr. Hastings is a member when they left by plane from San Francisco early in June. Their report is due August 1.

The survey group will inquire into steps which could be taken to restore essential transportation facilities, to develop sources of fuel, power, export industries, and coal mining, and to improve port facilities. Following its study, the group will make recommendations as to priority of construction of projects which would contribute most to the improvement of economic conditions in China. ECA expects to spend about 60 million dollars of the aid fund voted by Congress for industrial purposes.

PRINTED COPIES OF the Canons of Ethics for Engineers are now available from the office of Engineers Council for Professional Development, 29 West 39th Street, New York 18, N.Y., at 50 cents per copy or, in quantities of 10 or more, at 35 cents each. The sheets are 9½ × 14¼ in., printed in black with red subtitles and borden, on good stock suitable for framing. Developed from the various Codes of Ethics of a number of engineering societies, the Canons were prepared by an ECPD committee under the chairmanship of Dugald C. Jackson, M. ASCE (May issue, page 56).

Director Calls Limited Funds "Dangerous Handicap" to ASCE Endeavors

"PRACTICALLY EVERY ENDEAVOR of ASCE, technical and professional, is dangerously handicapped at the present time by limited funds," is the view expressed in District 8 by its national Director, Samuel A. Greeley of Chicago.

In bringing to his constituents the first-hand observations he has obtained during his year and a half as a member of the Board of Direction, Mr. Greeley has prepared for his own guidance "Some Personal Beliefs Regarding ASCE," from which the following are abstracted:

"We are living and practicing in a period of inflation when costs are high and unpredictable. In this changing world there is great need for the kind of knowledge and thoughtful individual judgment that is generally inherent in engineers. ASCE should endeavor strongly to develop these inherent characteristics and to make the services of engineers available and useful to their fellow citizens. These useful qualities in present national and world problems arise from and depend on the technical abilities and achievements of the profession. Without the technical achievements, inherently unselfish, there can be no great influence in public affairs.

"To provide an atmosphere in which technical ability can grow, it is obviously necessary to protect and expand the position of engineers in society and to provide for their security and advancement as a profession. The professional aims and activities should be oriented to national, as well as professional, welfare and should not be limited to narrow and selfish objectives."

Calls Activities Balanced

Discussing the ASCE program as now constituted as the result of actions and decisions of successive Boards of Direction, Mr. Greeley says:

"I do not believe that the balance in budget support between so-called technical and professional activities is much, if any, out of kilter. The balance must change as conditions change and (perhaps wisely) does not change as fast as conditions change today."

Mr. Greeley also is discussing with the Local Sections in his District the current budget of the Society and the thinking of the Board of Direction regarding next year's budget in relation to the forthcoming vote of the membership on the proposed constitutional amendments affecting increase in dues. He quotes from recent reports of the Special Standing Budget Committee, which is continuously studying the Society's income and expenditures, to the effect that the Executive Secretary's department is "efficiently and economically conducted," and that "so long as the Society maintains the present scope of activities, no substantial savings in administrative expense appear possible."

If dues are increased, Mr. Greeley refers to the intention of the Board to devote this increased income to:

1. Publishing the Yearbook in 1949.
2. Increasing the allotments to Local Sections approximately to the 1947 level.
3. Maintaining publications at the present or approximately the present level.
4. And if there is still a balance remaining, consider increasing allotments to publications and to technical and professional activities.

If the amendments are not adopted, Mr. Greeley points out that it will obviously be necessary to reduce the budget and quotes from a recent letter sent to the presidents of all Local Sections at the order of the Board of Direction that "it will be necessary to curtail expenditures below the 1948 level by about $25,000." This letter suggests that the principal sources of this decrease include the elimination of one or more of the branch offices, reducing the volume of publications or charging for PROCEEDINGS and reducing still further the contributions to Local Sections. Mr. Greeley points out that he does not favor eliminating the branch offices unless the policy of the Society as regards growth through the development of Student Chapters and Local Sections is to be much changed and restricted. This view illustrates the difficulty caused by insufficient funds of making both ends meet.

Technical Divisions Handicapped

Emphasizing the handicaps imposed on Society activities by inflation, Mr. Greeley states "no technical division has enough for its essential committee work," and calls attention to the fact that the Committee on Division Activities is planning a meeting this summer of the Technical Procedure Committee, which consists of the Division Activities Committee and the chairmen of the Executive Committees of Technical Divisions, for the purpose of coordinating the Society's technical activities with the budget for 1949. To effect such coordination, it is planned that the chairman of the Budget Committee will attend this meeting.

"Among the important problems in the field of Society activities are those relating to other technical and professional organizations," Mr. Greeley says. "These problems will have to be worked out by hard work and adjustment, if the engineering profession is to grow and increase in useful influence.

"The Society needs for its growth additional funds in substantial amount, and needs them quickly. I can see no excuse for not providing these funds."

Activities of Venezuelan Section of ASCE Reported

WORD HAS BEEN received from one of the Society's newest and most distant Local Sections, which was organized early in the year by ASCE members living in and near Caracas, Venezuela, that its activities are in full swing. Officers of the Venezuelan Section, which has a membership of 57, are Gabriel M. Disario, president; Ellis G. Shuler, vice-president; W. B. Hovey, secretary; and Dr. Mathias Brewer, Jr., treasurer.

The initial dinner meeting of the new Section was addressed by William D. Shannon, Seattle (Wash.) consultant, member of the Washington State Legislature, and former Vice-President of the Society. Mr. Shannon stressed the point that the Section can foster international good will by helping to establish a closer understanding between Venezuelan and American engineers.

Subsequent programs have been devoted to consideration of local water supply and treatment problems. At a recent meeting Ernest W. Steel, former professor of hydraulics at Texas A. & M. College and now sanitation engineer for the Instituto Nacional de Obras Sanitarias, discussed the design of the two treatment plants that are being built as a part of Caracas' current water-improvement program. On another occasion members of the Section were guests of the Instituto Nacional de Obras Sanitarias on an inspection trip to the Agua Fria dam project, which will supplement the Caracas water supply. This large earthen dam is being built under the direction of Paul Thurber, Assoc. M. ASCE.

ASCE Director Roy W. Crum Awarded Marston Medal

ROY WINCHESTER CRUM, member of the ASCE Board of Direction and director of the Highway Research Board of the National Research Council, Washington, D.C., recently was awarded the Marston Medal for "achievement in engineering" by Iowa State College, of which he is a graduate. Mr. Crum has been with the Highway Research Board since 1928. He is a past-president of the Iowa and District of Columbia Local Sections of the ASCE.

Roy W. Crum

The Marston Medal, established by Iowa State College through the inspiration and generosity of Anson Marston, ASCE Past-President and dean emeritus of the Iowa State College division of engineering at the time the award was created in 1938, is awarded to an engineering alumnus of the college in recognition of achievement.

District of Columbia Section Honors Assistant Secretary

OFFICERS OF THE District of Columbia Section of the ASCE honored E. Lawrence Chandler, who has been advanced from Eastern Representative in Washington to Assistant Secretary of the Society, with a recent testimonial dinner at the Cosmos Club. The attendance of about 20 engineers included Col. William N. Carey, ASCE Executive Secretary and nearly a dozen past-presidents of the Section. No formal speeches were made, but there were many words of praise for Mr. Chandler and sincere expressions of the great loss the Section is experiencing.

Section President C. Dwight Curtiss, deputy commissioner of the Public Roads Administration, presided, and Harold H. Marsh, consulting engineer, handled all arrangements for the dinner.

Others present included Hal H. Hale, executive secretary of the American Association of State Highway Officials; Gail Hathaway, Vice-President of the Society and assistant to the Chief of Engineers, U.S. Army; Charles J. Stevens, secretary of the Section and civil engineer with the Navy Bureau of Yards and Docks; William G. Hoyt, executive officer of the Water Resources Committee of the Department of the Interior; Kenneth W. Markwell, assistant commissioner of the Bureau of Reclamation; Prof. C. H. Walther, of George Washington University; Clifford A. Betts, civil engineer with the U.S. Forest Service; and Waldo E. Smith, treasurer of the Section and executive secretary of the American Geophysical Union.

Also gathered to honor Mr. Chandler were Kenneth L. Roberts, civil engineer with the U.S. Federal Power Commission; William H. Richards, cadastral engineer, General Land Office, Department of the Interior; John W. Oehmann, consulting engineer; Carl G. Paulsen, chief of the Water Resources Division of the U.S. Geological Survey; M. A. Dysinger, of the engineering staff, Southern Railway System; Vincent B. Smith, Washington editor for *Engineering News-Record* and *Construction Methods;* Edward Wenk, Jr., senior physicist at the David Taylor Model Basin; and Archie N. Carter, manager of the Highway Contractors Division, the Associated General Contractors of America.

Student Summer Employment Program Urged by ASCE Committee

TO FURTHER THE development of educational facilities in construction engineering through increased cooperation between the construction industries and engineering colleges, the ASCE Construction Division's Committee on Construction Engineering Education is promoting a program of undergraduate summer employment. Noting that civil engineering educators have long recognized the disciplinary value of such employment for undergraduates, the committee states that the student who has had practical experience during his summer vacation will return to his academic work better able to correlate theoretical training and experience.

"The varied personal contacts he has made during several months on a construction project will prompt him to acquire a more realistic attitude toward engineering and industrial relations. Furthermore, he gains a better understanding of his own potentialities and approaches graduation more self-reliant, experienced, and better trained for his prospective field of employment. The increasing mechanization of construction operations and the special abilities required for successful management of construction enterprises make imperative the cooperation between colleges of engineering and construction organizations in providing students with appropriate college training and field construction experience," according to the committee.

To implement its program of summer employment for engineering students, the committee has obtained the cooperation of the Associated General Contractors of America, which at recent meetings has adopted resolutions recommending "that construction education in connection with engineering education be actively encouraged," and "that the AGC, through its chapters and branches, take all possible steps to encourage the entrance of young men into the profession of civil engineering."

In October the Committee on Construction Engineering Education expects to canvass colleges for information on the different kinds of summer employment in which their civil engineering students were engaged. These records will provide basic data for a census on the subject.

REPRESENTATIVES OF ASCE AND ASSOCIATED GENERAL CONTRACTORS meet at Society Headquarters to discuss plans for closer cooperation between engineering and contracting segments of the construction industry. Left to right are: ASCE Executive Secretary William N. Carey; ASCE President R. E. Dougherty; Dwight W. Winkelman, president of AGC; and H. E. Foreman, vice-president of AGC.

Pacific Northwest Projects Slated for Discussion at Seattle Convention

NINE SESSIONS OF seven ASCE Technical Divisions, covering a variety of Pacific Northwest engineering projects, will feature the Society's 76th Annual Convention, to be held in Seattle, Wash., July 21-24. The theme of the meeting will center around multiple-purpose water projects, a subject of particular importance to the Pacific Northwest. Several of the technical sessions will feature discussions of the Columbia River and its tributaries, with special papers on the major engineering projects under consideration in the further development of the system. Members attending the meeting will have an opportunity to hear a discussion of the recent Columbia River floods in a paper on "Construction of the Willamette Valley Flood Control Project," by O. E. Walsh, district engineer for the Army Corps of Engineers at Portland.

A general session will be devoted to discussion of the cost allocation of multiple-purpose projects, under sponsorship of the Engineering Economics Division. There will also be meetings of the Air Transport, Power, Waterways, and Soil Mechanics and Foundations Divisions. The Construction and Structural Divisions have scheduled two sessions each. Speakers and their subjects are listed in the meeting program published in detail in the June issue of CIVIL ENGINEERING (page 17).

Dues Amendments to Be Discussed

The two proposed consitutional amendments for increase of ASCE dues will be discussed at the general membership meeting on Wednesday morning, July 21. Another feature of the general business session will be the annual presidential address, delivered by ASCE President R. E. Dougherty. Other scheduled speakers include Bertram P. Thomas, president of the Seattle Section, and Mayor William F. Devin, who will welcome the convention. An over-all picture of the economic aspects of the development of Columbia River power, presented by Eugene L. Grant, professor of the economics of engineering at Stanford University, will conclude the program.

Dues Amendment Notice Mailed

PROPOSED AMENDMENTS to the ASCE constitution regarding an increase in dues are presented in a pamphlet mailed from Society Headquarters June 16 to all members. Emphasis is placed on the fact that the mailing piece is not a ballot but is merely for reference. The purpose of the pamphlet is to put all members on notice that the proposed constitutional amendments are to be discussed at the July Business Meeting of the Society, preparatory to actual balloting later.

Interesting Excursions Planned

Numerous points of engineering and scenic interest in the Seattle area will be visited on Friday and Saturday. On Friday members and their guests will be given their choice of a tour of the Boeing Aircraft Co., where the giant B-50's are being manufactured, or an all-day trip to the Puget Sound Navy Yard at Bremerton, Wash. The late afternoon and early evening will be devoted to a boat trip on Seattle's lakes and Puget Sound by way of the Lake Washington Ship Canal and Locks. This trip will afford an interesting close-up of the floating concrete pontoon bridge spanning Lake Washington at Seattle.

Mud Mountain Dam on the White River, an earthfill flood-control structure completed just before the war by the Seattle District of the Army Corps of Engineers, will be the objective of an all-day excursion on Saturday. En route the group will witness a logging demonstration, arranged by the White River Lumber Co., stopping for lunch in Mt. Rainier National Park.

Social Activities

Social events include a general luncheon on Wednesday—to be addressed by Dr. Paul J. Raver, administrator of the Bonneville Power Administration on "Power Development in the Pacific Northwest"—and a dinner dance on Wednesday evening. The special entertainment planned for the ladies will include a visit to the Seattle Art Museum, a drive through the University of Washington arboretum and campus, and a theater party.

Local Section Conference

A conference of representatives of Local Sections in the West and Northwest will take place in the Olympic Hotel on Monday and Tuesday, July 19 and 20, preceding the general meeting. Although this conference is intended primarily for Local Section delegates, it will be open to anyone specially interested in Local Section activities.

J. Waldo Smith Hydraulic Fellowship Is Again Available

GRADUATE STUDENTS WITH a flair for hydraulic research will be interested in the 1948 award of the J. Waldo Smith Hydraulic Fellowship, which will be given for the first time since the war. A program covering possibilities for study has been selected by the committee in charge. Four options of experimental work are offered in the following suggested lines of research:

1. To determine a practical working relation between diameter of pipe, slope of pipe downward in the direction of flow, slope of hydraulic gradient, average velocity of flow, and possibly other variables, and ability of the velocity to carry air bubbles along and prevent accumulation of air at a high point in the line; also to determine the rate of correction or the degree of certainty with which an increased velocity will entrain and remove the air after it is once accumulated. Lucite pipe is suggested, including a tangent run on the adjustable slope, preferably not less than 10 ft long, and a bend of radius preferably not less than 25 diameters, and long enough to permit a wide range in the adjustment of the tangent slope. The air should be fed into the line on the upgrade ahead of the high point under minimum pressure so as to avoid as much as possible any help from entrainment of the air at the entrance point and so as to simulate a gradual movement of air along the top of the pipe toward the high point. It is desirable to include large diameters, but difficulty in securing and using them may limit the size to 20 in. Preferably, as many as 6 sizes should be used, extending to as little as 4-in. diameter in order to establish the proper relationships.

2. To determine, in the case of a discharge of water through a nozzle into a body of still water, a practical working relation between the size and velocity of the nozzle and the size and form of the stilling pool, and the most efficient form and arrangement of nozzle, etc., to best absorb the energy of the discharge. It is desirable to cover a range of discharges and velocities up to the highest practicable rate allowed by the laboratory equipment. Maximum rates of not less than 20 cfs and 60 fps are desirable.

3. (*a*) To look up all published data concerning the theoretical relations between pipe factor or pipe coefficient, as it is sometimes called, and the friction factor, pipe factor meaning the ratio of mean velocity to

center velocity of a pipe. Reference: Various hydraulic textbooks plus a paper in the ASME TRANSACTIONS of August 1939 by C. W. Hubbard, entitled "Investigations of Errors of Pitot Tubes" and

(*b*) Collect data from actual tests. The Pitometer Company, 50 Church Street, New York City, have in their files a large number of actual tests of traverses made by the Pitometer in small as well as large pipes. There are also records of tests in the files of the Alden Hydraulic Laboratory at Worcester Polytechnic Institute.

(*c*) Experimental tests. The applicant is to recommend place and manner of making additional tests and to consult the committee as to the program of testing for approval.

4. To determine the hydraulic relations which exist when the flow in a large pipe or channel is divided so that a portion discharges over some form of weir at right angles to the normal flow. Experiments to be made first for the diversion of flow from a rectangular channel over a sharp-crested weir for various conditions of flow. This experiment to be expanded later to other shapes of main channel and other weirs.

General terms of the award are detailed in the 1947 Yearbook, page 137. It will be noted that the fellowship is of joint interest to the graduate student and the institution through which he will work, and that the application will be routed through the institutions themselves. Particular attention is called to one special revision of the terms, whereby the monetary allowance is being increased for the current award to the amount of $1,000, plus an allowance for equipment up to $400.

The work of the current fellowship award will be done in the regular 1948–1949 academic year. Applications are open immediately and will continue until August 15. It is expected the award will be determined not later than September 1, so that the work itself may be put into operation by October 1, 1948, to run for a full year. Applications should be addressed to the Society.

NOTES FROM THE *Capital*

E. Lawrence Chandler, M. ASCE
Assistant Secretary ASCE

CULMINATING WELL OVER a decade of study, Congress has at last acted favorably on legislation relating to the control of water pollution. S.418, which was passed by the Senate and then remained in the hands of the House Committee for many months, finally received favorable action during the last hours of the session. As of this writing, the bill lacks only the signature of the President to make it law, and it is expected that he will approve it.

To the great disappointment of the engineering profession, H.R.4884, Congressman Carl Hinshaw's bill for the registration of professional engineers in the District of Columbia did not come before the House for action. No substantial opposition to the legislation is known to exist, but like many another bill, it was submerged in the great rush of business.

Legislation for establishment of a National Science Foundation unfortunately was lost in the shuffle during the hectic, last-minute confusion which attended adjournment of Congress. The House Committee had acted favorably on H.R.6007, which differed in some respects from S.2385 which was passed by the Senate. Because of assurances that had been received that this legislation would have high priority for Congressional action, it is believed that, should Congress reconvene (a possibility of which there is considerable likelihood), passage would be fairly certain. None of the differences between the Senate and House versions are of substantial consequence from the engineering point of view, and any compromise should meet with general approval in engineering circles.

Engineers Joint Council for some time had been making preparations for supplying President Truman with a list of qualified engineers from which appointments to the Foundation might be made. It is suggested in the legislation that the President obtain the advice of scientific and educational institutions when making appointments.

Looking forward to the time when appointments will be made, the constituent societies of Engineers Joint Council, as well as the American Society for Engineering Education, prepared lists of prominent engineers deemed to be qualified for service. These lists were placed before the EJC Committee on Science Legislation which chose 23 as being the most appropriate candidates. In addition to those specifically representing the several societies, five of the men included were selected as engineers eminent in public affairs.

On June 4, a delegation of six, headed by Dr. Boris A. Bakhmeteff, Hon. M. ASCE, met with Dr. John R. Steelman, adviser to President Truman, at the White House, presented the list of candidates and discussed reasons why engineering should be well represented on the Foundation. The group met with a cordial reception, and assurance was received that full consideration will be given to the engineers' recommendations.

Heating Contractors Hear ASCE Assistant Secretary

WHILE SOME COMPONENTS of the construction industry are confronted with difficult problems, they appear to be "solvable by earnest and cooperative effort," E. Lawrence Chandler, Assistant Secretary ASCE, told members of the Heating, Piping & Air Conditioning Contractors National Association at their recent annual convention in Pittsburgh, Pa.

Mr. Chandler spoke on "Business Conditions and Their Effect on Building," expressing the belief that "we are justified in feeling that our economic system is in pretty good shape generally" and that the "construction industry has before it an unparalleled volume of work and opportunity for expansion."

Industry, he said, has displayed "an admirable spirit of cooperation in trying to make effective, despite difficult conditions, the current system of voluntary allocation of critical materials.

"There is plenty for all branches of the construction industry to do. If we can obtain the facilities to do with, I believe we will measure up to our responsibilities. Prospects are better now than they were a year ago, but the volume of construction in percentage of total national income still is far short of what it should be in the light of experience. We should look forward to doubling the present-day volume of construction in order for the industry to take its appropriate place in the business activity of the country."

Mr. Chandler commended the programs for apprentice training in which the federal government, contractors, and labor unions are currently cooperating throughout the country as a vitally important means of expediting construction and helping to relieve the critical shortage of skilled labor.

James Chinn Recipient of Milo S. Ketchum Award

JAMES CHINN, ASCE Student Chapter member at the University of Colorado, received the 15th Milo S. Ketchum Award at the annual Ketchum Award Dinner, held recently in Boulder, Colo. About 100 Student Chapter members attended the dinner, which was addressed by R. D. Lindsay, vice-president of the Mountain States Telephone and Telegraph Co., Denver, Colo.

The award, given each year in memory of the late Milo S. Ketchum, was established by former engineering students of Dean Ketchum, who died in 1934. Administered by the Colorado Section, the award consists of the payment of the recipient's initiation fee as a Junior in the Society.

C. Frank Allen Longest on ASCE Rolls, Is Dead

WITH THE DEATH of Honorary Member C. Frank Allen in Boston June 6, the ASCE lost its oldest member in point of Society affiliation. Mr. Allen, who was 97, became a full member of the ASCE in 1878. Sixty years later, in 1938, he was made an Honorary Member.

C. Frank Allen

An alumnus of Massachusetts Institute of Technology, class of 1872, he served as assistant professor of railway engineering there from 1887 to 1896. From the latter year until his retirement in 1916 with the rank of professor emeritus, he was professor of civil engineering. A lawyer as well as an engineer, Mr. Allen was admitted to the Massachusetts Bar in 1901, and was author of *Business Law for Engineers*. Another of his widely used texts, *Railroad Curves and Earthwork*, reflected his early experience on railroad engineering work in the West.

Long active in the Northeastern Section of the Society, Mr. Allen played a prominent part in the Section's study of engineering ethics, on which the Society's Code is largely based. For more than 65 years he served as secretary of his college class, and also had been secretary of the M.I.T. Alumni Association.

New ASCE Committee to Administer Freeman Fund

BY AUTHORIZATION OF the Board of Direction, the Society Committee on the Freeman Fund has now been reconstituted, under the chairmanship of Morrough P. O'Brien, M. ASCE, with the following personnel: H. B. Kinnison, William Allan, Gordon R. Williams, and Abel Wolman. Mr. O'Brien's term ends in September 1948; the others' terms will end in September 1949, 1950, 1951, and 1952, respectively.

The committee is undertaking a review of its program and possibilities. The present incumbent of the fellowship is Lt. Col. George F. Dixon, Jun. ASCE, who is enjoying a year of study abroad, with headquarters at The Hague.

PICTURED AT RECENT FRESNO CONFERENCE of Local Sections in California are (left to right) ASCE President R. E. Dougherty, Vice-President J. W. Cunningham, and Ernest C. Fortier, of staff of Bureau of Reclamation. More than 400 attended Fresno Conference, first get-together of California Sections, which will be made annual event (story of conference in June issue, page 57).

Papers Filed in Engineering Societies Library

THE ENGINEERING SOCIETIES Library has received through the ASCE a number of manuscripts that are believed to be worthy of study and reference by engineers. These manuscripts are available for reference at the Library or, if desired, photoprint copies may be obtained by arrangement with the Library. Inquiries should be addressed to the Engineering Societies Library, 29 West 39th Street, New York 18, N.Y. Following is a list of papers recently filed:

Cavitation in Hydraulic Structures by Ali Fahmi El-Kashef, Assoc. M. ASCE, as submitted for the M.S. degree, Johns Hopkins University (30,000 words of text and 60 illustrations). This is a review of cavitation phenomena to date.

Foundations to Resist Tilting Moments by W. C. Anderson (about 5,000 words of text and tables, supplemented by six figures and graphs). This paper proposes a practical method for investigating the stability of poles and masts embedded in the ground and resisting a horizontal force applied at some height above the ground.

Certain Theories of Concrete in Flexure and Certain Concrete Cylinders Tested in Compression by Homer M. Hadley, M. ASCE (about 7,000 words plus six diagrams and three photographs). Based on computations by least work, this paper advocates continuance of the straight-line pattern of stress distribution, subject to some increase in permissible working stresses.

Classified Bibliography on the Physical and Mechanical Properties of Wood and the Design and Construction of Timber Structures by the Committee on Timber Structures of the Structural Division, (about 21,000 words of text, comprising about 800 separate items). This extensive bibliography, prepared by a committee of 14 experts under the chairmanship of Howard J. Hansen, Assoc. M. ASCE, is subdivided by subject matter, from Aircraft to Wood Preservation.

Framework Method and its Technique for Solving Plane Stress Problems by A. Hrennikoff, Assoc. M. ASCE (text and tables comprise about 10,000 words; also included are about 40 diagrams). After discussing in detail the working procedure, this paper applies the framework method to the specific example of a gusset plate of a truss.

Culvert and Catch-Basin Connection Flow Coefficients—Similarity—Extrapolation by G. S. Tapley, Assoc. M. ASCE (about 7,000 words of text and tabular matter and 25 line cuts). Primarily this paper discusses flow in square and circular culverts of short or moderate length, in which the entrance effects are moderately great. The possibility of an optimum (oblong) cross section for short tubes is also suggested.

Analysis of Stepped Members by Super-Position by John Sherman, M. ASCE (about 9,000 words, plus 20 tables and over 20 figures). An attempt to simplify the solution of moments and deflections in stepped or tapered members by means of tabular coefficients based on ratios of distances and fractions of spans comprises this paper.

A New Highway Transition Curve by Joe W. Keeley, Assoc. M. ASCE (text and tabulations include about 6,000 words, with seven diagrams and graphs). The transition proposed is that in which the superelevation from zero to maximum varies as a reverse parabolic curve, and the radius of curve at any point is that required for the superelevation.

Factors in Airport Drainage by Edward Koehm, Assoc. M. ASCE (about 4,000 words of text and nine diagrams). The purpose of the paper is to describe an approximate method of design for drainage of airports, as a substitute for the exact rigorous method in previous use.

Student Chapter Group Aids Summer Employment Program

ON BEHALF OF undergraduate civil engineering students in the New York area, the Metropolitan Conference of Student Chapters of the Society has inaugurated a program to provide summer employment, in cooperation with the eight schools comprising the conference. These schools include Columbia, New York, and Rutgers universities, the College of the City of New York, Cooper Union, Newark College of Engineering, the Polytechnic Institute of Brooklyn, and Manhattan College.

Cooperation is being sought from engineering firms, railroads, contractors, and public service departments in an attempt to place engineering students in positions during the months of June to September, inclusive.

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

ANNUAL CONVENTION
Seattle, Wash., July 21–23
(Board of Direction meets July 19–20)

FALL MEETING
Boston, Mass., October 13–15
(Board of Direction meets October 11–12)

ANNUAL MEETING
New York, N.Y., January 19–21
(Board of Direction meets January 17–18)

Recent Activities

ARIZONA

IN A SYMPOSIUM on Society and Local Section activities that opened the Arizona Section's all-day spring meeting, members discussed the proposed increase in ASCE dues; job classification and engineers' salaries; and the possibility of uniting with other engineering and architectural groups in the state to form a state organization that would effectively represent the two professions. ASCE Director Julian Hinds addressed the session briefly on the subject of Society affairs. Presentation of the Section's annual Student Chapter award—to Lars Holmquist, of the University of Arizona—was a feature of the noon luncheon meeting. P. F. Glendening presented a paper on "The Arizona Technical Registration Law Compared with the Proposed Model Law," which was discussed by V. H. Housholder, a member of the Arizona Board of Registration. Speakers at the afternoon technical session included Roy E. Cabell, engineer for the U.S. Geological Survey, and a panel of students from the University of Arizona—Theodore Rowcliffe, Lars Holmquist, A. P. White, and A. M. Boles.

BUFFALO

The $22,000,000 Mt. Morris Dam project, now under construction on the Genesee River near Mt. Morris, N.Y., was discussed at a recent luncheon meeting by S. B. Hunt and R. H. Gallinger, respectively chief of the Engineering Division and assistant chief of the Construction Division of the Buffalo District office of the Army Corps of Engineers. According to the speakers, present plans call for a concrete-gravity structure 1,050 ft long and 240 ft high, with a 550-ft spillway section. When completed, it will be the highest dam east of the Mississippi. Col. Harland C. Woods, Society Director for District 3, spoke briefly on the proposed ASCE dues amendments.

CLEVELAND

IN ORDER TO gain experience in conducting, and participating in, their own meetings, the Juniors of the Cleveland Section have organized a Junior Forum. Other aims of the Forum are to meet members of the profession and to function more effectively in Section and Society affairs. Jack Scalti is acting chairman of the group.

COLORADO

RESEARCH COSTING IN excess of $500,000 is now in progress at the University of Colorado Engineering Experiment Station and expansion of the work may involve double that amount before the end of the year, Executive Director Frederick A. Rohrman told members of the Section. Speaking at the annual Student Chapter Night, sponsored by the university, Dr. Rohrman described current research on such subjects as concrete, corrosion of metals, and solar heating of buildings. During the evening, the Section presented its annual awards of Junior membership in the Society to Warren S. Marshall and James M. Hastings, both of the University of Colorado.

CONNECTICUT

SPEAKING ON "The Development of the Yorktown Bridge Project" at a recent meeting, E. L. Macdonald, New York consultant, described how his firm's development of plans to meet the limitations imposed on the structure by various interests resulted in a novel design. A feature of the program was the presentation of Section prizes of $10 to Aron Mirsky, of the University of Connecticut, and Albert S. Crandon, Jr., of the Yale School of Engineering.

GEORGIA

RECENTLY EXPANDED LABORATORY facilities of the civil engineering department at the Georgia Institute of Technology were demonstrated at a recent meeting held on the Georgia Tech campus. Following a dinner and business session, members of the Section were conducted through the new soil mechanics, sanitary engineering, and hydraulics laboratories. Developed since 1946 under the direction of T. H. Evans, head of the civil engineering department, the new laboratories are a part of the department's general program of expansion.

FLORIDA

REVISION OF THE structural steel and reinforced concrete sections of the Jacksonville Building Code has been accomplished by recommendation of a special Section committee appointed to study the code, P. M. Huddleston, chairman of the committee, reported at a recent meeting. The remainder of the program was devoted to business discussion and to the showing of films—on the manufacture of wrought iron and the construction of the Pennsylvania Turnpike.

ILLINOIS

RECIPIENTS OF THE Section's annual awards of Junior membership in the Society, presented at a luncheon meeting on June 4, are Robert B. Banks and Kenneth Brunner, of Northwestern University; Robert S. Wright and Harry G. Kabbes, of the University of Illinois; and Burton Lewis and Alexander Koehler, of the Illinois Institute of Technology. ASCE Honorary Member Hardy Cross, professor of civil engineering at Yale University, addressed a recent joint dinner meeting with the Illinois Institute of Technology on the subject "Why Com-

pute What." Almost 300 attended the dinner, which was held in honor of Professor Cross.

INDIANA

THE OUTLOOK FOR engineering employment was discussed by ASCE Director D. V. Terrell, dean of engineering at the University of Kentucky, at a joint meeting with the Student Chapters at Purdue University, Rose Polytechnic Institute, and the University of Notre Dame. Other guests included ASCE Vice-President R. B. Wiley and Midwest Representative George S. Salter. Leon Abele, president of the Purdue Chapter, was in charge of the program, which included musical entertainment furnished by the college.

IOWA

CONVEYORS HAVE PLAYED an important part in the development of our mass production industry, R. W. Rausch, chief engineer of the Pershing Road Plant of the Link-Belt Co., pointed out at a recent meeting. Mr. Rausch gave an illustrated lecture on "Conveyor Systems in Industry" before a well-attended joint meeting with the Iowa State College Student Chapter.

KANSAS

OPPORTUNITIES FOR YOUNG civil engineers in the construction industry were outlined at a recent meeting by M. W. Watson, general contractor of Topeka, Kans. During the evening Section awards of Junior membership were presented to William J. Hall, of the University of Kansas, and Loyd E. Peterson, of Kansas State College. The attendance of 50 included many Student Chapter members.

MID-SOUTH

PROGRESS MADE BY the engineering profession, especially during the war, was reviewed by ASCE Executive Secretary William N. Carey at the spring meeting of the Mid-South Section in Memphis. Colonel Carey also discussed Engineers Joint Council as an effective medium, through which the profession is expressing itself on matters of national and international interest. Recent activities of the Society were summarized by ASCE Director Webster L. Benham, who led a discussion from the floor on financial aspects of Society functioning. Technical papers presented on the all-day program were by Frank Masters, partner in the Harrisburg, Pa., consulting firm of Modjeski & Masters, who described the new Memphis highway bridge; William B. Fowler, city engineer of Memphis, who discussed the Memphis approaches to the new bridge; and Paul Seavy and E. C. Bowman, engineers from the Memphis District of the Corps of Engineers, whose subject was "Modern Mapping with an Aerial Camera." In a talk entitled "This Age in Which We Live," presented at the luncheon, Blanchard Tual, Memphis attorney, stressed the necessity of putting moral and spiritual values ahead of material considerations in this atomic age.

KANSAS CITY

THE APPLICATION OF test procedures, dye studies, drilling, and pressure grouting in detecting and stopping leakage through the abutments of the Marshall Creek Dam in Wyandotte County, Kansas, was described at a recent meeting of the Juniors of the Section by E. T. Stinson of the Burns & McDonnell Engineering Co., Kansas City. Discovering the leaks, which occurred as almost vertical cracks in the bedrock, required the drilling of a number of holes and considerable "detective work," according to the speaker. At the conclusion of his talk, Mr. Stinson was assisted in answering questions by G. E. Hands, also of Burns & McDonnell.

KENTUCKY

PRESENTATION OF SIX papers by Student Chapter members in the annual Section competition for Junior membership awards featured a recent joint dinner meeting with the Chapters at the University of Louisville and the University of Kentucky, to which the latter Chapter was host. Grand prize winner was William B. Drake, of the University of Kentucky. B. W. Napier, Jr., of the University of Louisville, placed second, and third prize went to William R. Belcher, of the University of Kentucky. A panel of members of the ASCE Committee on Student Chapters, who were meeting in Lexington at the time, served as judges, under the chairmanship of Finley B. Laverty, of Pasadena, Calif. Other guests of the Section included ASCE Director D. V. Terrell; Prof. E. A. Gramstorff, chairman of the Committee on Student Chapters; George S. Salter, ASCE Mid-West Representative; and Don P. Reynolds, assistant to the Secretary of the Society. All spoke briefly on various phases of Society and Student Chapter activities. J. W. Scott, president of the University of Kentucky Chapter, served as toastmaster for the occasion.

ASCE COMMITTEE ON STUDENT CHAPTERS meets in Lexington, Ky. (upper photograph), to plan activities for 1948–1949 school year. Pictured left to right, are J. M. Faircloth, Alabama; D. V. Terrell, Kentucky; R. A. Marr, Jr., Virginia; Chairman E. A. Gramstorff, Northeastern; F. C. Tolles, Toledo; F. A. Laverty, Los Angeles; and C. P. Hazelet, Kentucky. Lower photograph shows, left to right, Finley Laverty, who headed panel of judges in prize paper competition; A. L. Chambers, Faculty Adviser, University of Kentucky Chapter; William B. Drake, first prize winner; William R. Belcher, third prize winner; B. W. Napier, Jr., second prize winner; W. R. McIntosh, Faculty Adviser and president of Kentucky Section.

MARYLAND

OUR SKYSCRAPERS WOULD be especially vulnerable to atomic-bomb attack, Lt. Col. David B. Parker warned members of the Maryland Section at a recent dinner meeting. In a talk on the subject, "Atomic Bomb Effects on Structures," Colonel Parker stated that studies of bomb damage in Japan reveal that reinforced concrete structures withstand the bombing better than brick or steel. Colonel Parker, who is at present assigned to the Armed Forces Special Weapons Project, recommended the construction of 100-ft buildings, half cylindrical in shape with spherical ends, to protect personnel. Special subterranean shelters afford the best all-around protection, he said, but cost too much for extensive use.

LOS ANGELES

HYDRODYNAMICS RESEARCH AT the California Institute of Technology was discussed by Robert T. Knapp, director of the Hydrodynamics Laboratories, at a recent meeting held at the Institute. The present hydrodynamics research program includes a harbor project, studies in sediment transportation, and work on underwater ordnance. The investigations on cavitation were discussed with the aid of a motion picture taken at 30,000 exposures per second.

OREGON

PRESENTATION OF A joint paper on "Investigation of a Timber Indeterminate Bridge Structure Recently Constructed on the Oregon Coast" by Charles F. Craig and Robert E. Eby, winners in the Section's annual Junior membership award contest, featured a recent joint meeting with the Oregon State College Student Chapter. J. C. Stevens, Past-President of the Society, addressed the group briefly on the desirability of encouraging a close relationship between students and corporate members. A talk on the Oregon highway system—given by R. H. Baldock, chief engineer of the Oregon State Highway Department—concluded the program.

METROPOLITAN SECTION

MEMBERS OF THE Junior Branch recently made a two-day trip to inspect construction operations at Merriman and Neversink dams in the Catskill watershed. Built to augment the New York City water supply, these two dams will be the largest earthfill structures east of the Mississippi. At the Merriman damsite, the group watched earthmoving and compacting operations, and inspected the grizzlies, borrowpit, intake structure, and temporary diversion channel. At Neversink, the concrete corewall and diversion tunnel intake were visited. The trip was made possible through the efforts of ASCE Director Irving V. A. Huie, president of the Board of Water Supply, and Joseph D. Lewin, engineer for the Board. The annual meeting featured a talk by John Bumstead, assistant editor of *Engineering News-Record*, on "A Sanitary Engineering Program for the Rio Doce Valley in Brazil."

New officers for the Branch are: Elwyn H. King, president; Rudolph F. Rinderer, first vice-president; Harold E. Levenson, second vice-president; S. Ralph Angell, secretary; and Paul Oberleitner, treasurer.

The recipients of awards in the Robert Ridgway Student Chapter prize contest, announced in the June issue of CIVIL ENGINEERING page 66, are: Paul R. DeCicco, Brooklyn, N. Y., Brooklyn Polytechnic Institute; Herbert Wasserman, New York, College of the City of New York; Herbert Tyson, Brooklyn, Columbia University; Robert Heins, Elmhurst, Long Island; Cooper Union; John A. Gilligan, Orangeburg, N. Y., Manhattan College; Anthony M. Lunetta, Little Falls, N. J., Newark College of Engineering; Manuel E. Emanuel, New York, New York University, and John P. Sass, New Brunswick, N. J., Rutgers University.

OFFICERS OF JUNIOR BRANCH OF METROPOLITAN SECTION are shown on recent inspection trip to Merriman and Neversink dams. Photographed, left to right, are: Harold Levenson, second vice-president; Paul Oberleitner, treasurer; Elwyn H. King, president; Brother B. Austin Barry, past-president; Joseph D. Lewin, who arranged trip; and Ralph Angell, secretary.

GROUP OF 135 MEMBERS OF JUNIOR BRANCH OF METROPOLITAN SECTION is pictured on inspection trip to new earthfill dams under construction in Catskill watershed, arranged through courtesy of New York Board of Water Supply.

PANAMA

A PANEL OF engineers in the Special Engineering Division of the Panama Canal presented a symposium on the proposed sea-level canal at a recent meeting. Participants were Harry W. Adams, chief of the Hydrology Section, whose subject was "Flood Control Hydrology"; L. T. Crook, chief of the Contracts, Specifications, and Schedules Branch, who read a paper by Forrest L. Dye on "Preliminary Design of Special Dredges"; F. S. Brown, chief of the General Engineering Branch, who discussed "Channel Design for a Sea-Level Canal"; and J. Stuart Meyers, chief of the Hydraulics Section, who gave an illustrated talk on the subject of "Ship Model Operation in Sea-Level Canal Model."

ST. LOUIS

IMPLICATIONS OF THE housing problem in the St. Louis area were discussed at a recent luncheon meeting by Harland Bartholomew, St. Louis consultant. Mr. Bartholomew pointed out that St. Louis has a serious housing problem. When the present shortage is relieved, further decentralization of population to more open types of development in suburban areas can be expected, he said. Because of the scarcity of vacant land, housing in the city cannot meet such competition, and the result will be lessened demand, more vacancies, and further deterioration. To preserve the local economy, Mr. Bartholomew recommends improved standards of existing housing, and extensive new construction. Section awards of Junior membership in the Society were presented to Albert G. McGuire, of the Missouri School of Mines, and Charles S. Johnson, Jr., of Washington University.

SAN DIEGO

A TALK ON "Acoustics in Engineering" was given by C. R. Moe, professor of physics at San Diego State College, at a recent meeting held on the college campus, with the Engineers' Association of the college acting as host. Professor Moe explained how geologists apply the science of acoustics to subterranean explorations, and how the acoustical method may also be applied to depth gaging at sea. H. W. Rand, student president of the Engineers' Association, was in charge of the program which included a tour of the engineering facilities of the campus. ASCE President R. E. Dougherty at another recent meeting spoke on Society activities, commenting particularly on the proposed amendments for increase in dues. The technical program for the occasion consisted of a talk on physical, chemical, and biological peculiarities of water supply.

TENNESSEE VALLEY

PROBLEMS IN PROFESSIONAL development were outlined by N. W. Dougherty, dean of engineering at the University of Tennessee, at a joint meeting of the Knoxville Sub-Section of the Tennessee Valley Section and local groups of the other Founder Societies. The program for the occasion was prepared under the direction of George Hoffman, of the Allis Chalmers Manufacturing Co., with Roscoe Morton, professor of mechanical engineering at the University of Tennessee, serving as meeting chairman.

The principal speaker at a recent meeting of the Holston Sub-Section, held in Elizabethton, Tenn., was Judge J. Frank Seiler, who discussed the early history of East Tennessee.

TENNESSEE VALLEY SECTION PRESIDENT WILLIAM N. CALVERT, JR. (left center) and James E. Goddard (right center) spring meeting program chairman, are shown with officials of Ecusta Paper Corp., Pisgah Forest, N.C., on recent inspection trip, one of highlights of spring meeting of Section (see June issue of "Civil Engineering," page 68).

SAN FRANCISCO

GUESTS AT A recent spring dinner meeting included ASCE President R. E. Dougherty and Executive Secretary William N. Carey. Both spoke briefly on Society affairs. Presentation of a paper on "The Future of the Panama Canal," by Brig. Gen. Hans Kramer (retired) comprised the technical program.

SEATTLE

ENGINEERING FEATURES OF the Columbia Basin Irrigation Development were discussed at a recent meeting by H. A. Parker, supervising engineer for the Bureau of Reclamation on the project. The location of dams, reservoirs, and pumping units, in relation to the general topography of the area, was described. Mr. Parker also discussed the canal system, and gave a brief idea of the economic and topographic considerations that dictated canal locations. Estimates of the cost of the project, the largest single irrigation undertaking in the country, range between $300,000,000 and $400,000,000.

WISCONSIN

PROBLEMS FACING THE engineering profession all over the world were discussed by ASCE Vice-President Ralph B. Wiley at a recent dinner meeting of the Section. Professor Wiley advocated increased interest and participation in the affairs of government. Engineers can and should influence public opinion, he stated. The principal speaker at another recent meeting was Raleigh W. Gamble, superintendent of the Milwaukee Bureau of Street Construction and Repairs, who described the city's growing traffic problem. Among factors creating the present traffic complications, he listed the city's rapid growth and annexation of adjacent communities, conversion from street railways to trackless trolleys, reduction of normal construction and repair of streets over a 15-year period, and increase in automobile traffic. He recommended the construction of expressways as one solution to the problem, citing figures to show that one expressway section in the city is 20 times safer than the ordinary highways, despite the fact that the speed limit on the latter is only 40 percent of that permitted on the expressway. The annual Ladies Night was celebrated on June 3.

TEXAS

SEVERAL INDUSTRIAL ENGINEERING subjects were discussed in technical papers presented at the recent two-day spring meeting of the Texas Section, in Corpus Christi. Authors included F. D. Mayfield, chief of processing, engineering department, Celanese Corporation of America, Bishop, Tex., who described the role of South Texas petroleum in the celanese production of chemicals, plastics, and textiles; Fred Norton, manager of the Corn Products Refining Co., Corpus Christi, whose paper was entitled "Starch Products from Milo Maize for Food and Industrial Use"; and Duane Orr, port engineer for the Nueces County Naviga-

tion District, Corpus Christi, who described a projected protection program for the port of Corpus Christi and its adjacent industrial area that was formulated after the Texas City disaster of a year ago. A luncheon, held during the meeting, was addressed by ASCE Director C. Glenn Cappel and Mid-West Representative George S. Salter who discussed the proposed amendments for increase of dues and other Society affairs. Other highlights of the meeting included a party given the group by the South Texas Chapter of the Associated General Contractors of America; a dinner dance and magician's show; and the annual Student Chapter breakfast (reported in the June issue of CIVIL ENGINEERING, page 60).

WEST VIRGINIA

A RECENT MEETING consisted of an afternoon inspection trip to view tunneling operations of the Weirton Coal Co., followed by a dinner meeting in Morgantown in the evening. The tour of mining operations was conducted by G. M. Rigg and C. W. Thompson, general manager and chief engineer for the Weirton Coal Co., and J. L. Willetts, superintendent of the work, outlined the methods of tunneling in use. The dinner meeting was addressed by H. E. Anderson, head of the Projects Branch of the U.S. Engineer Office at Pittsburgh, who discussed proposals for constructing three new dams and locks in the upper Monongahela River and for enlargement of existing navigation channels in order to improve the flow and reduce the cost of traffic on the river. A feature of the program was the presentation of the Section's award of Junior membership in the Society to James Earl Foreman, Jr., of the University of West Virginia.

STUDENT CHAPTER *Notes*

UNIVERSITY OF WYOMING

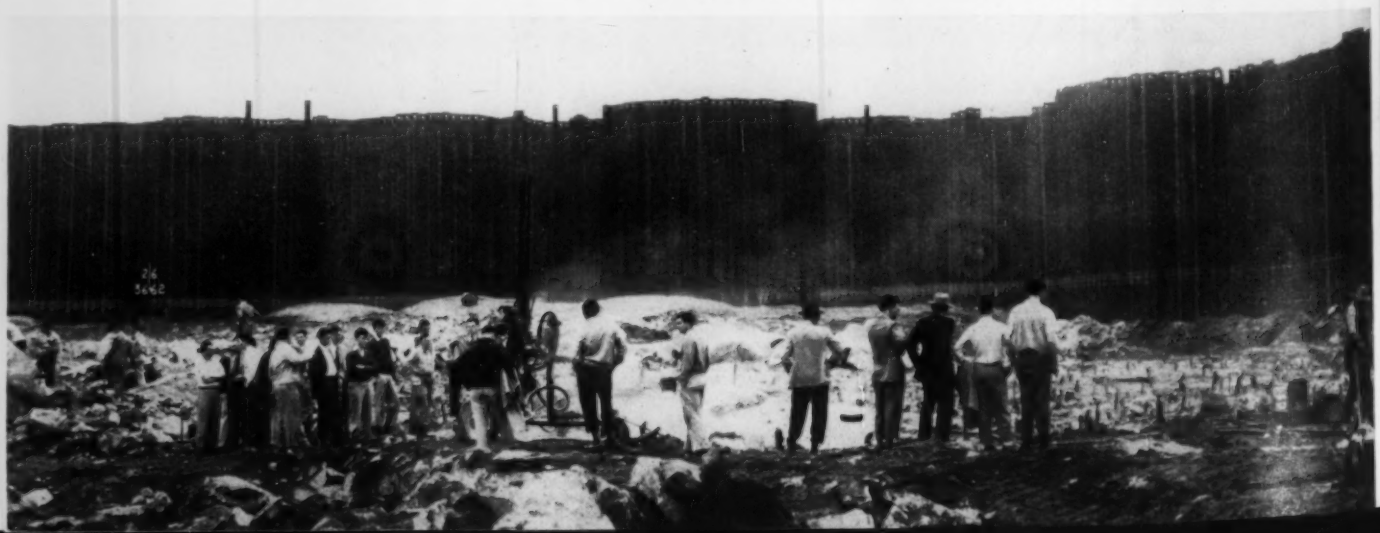
STATE LAWS REGARDING use and distribution of water throughout the state were explained by L. C. Bishop, Wyoming state engineer, Cheyenne, at a recent meeting. At the same session a new constitution was adopted by the Chapter. John Wiley, right of way engineer for the Wyoming Highway Department, was guest speaker at another meeting.

UNIVERSITY OF SOUTH CAROLINA

AN ALL-DAY trip to the Clark Hill Project on the Savannah River, 23 miles above Augusta, Ga., was made recently by 40 members of the Walter E. Rowe Student Chapter at the University of South Carolina. The project, to consist of an earth and concrete dam, will be used for power and flood control. Chapter members viewed the excavation for the dam foundation on the west shore of the project, and construction of a temporary steel and timber bridge, to be used for transporting heavy construction materials across the river. They also visited the soils laboratory at the site.

PICTURED ATOP WEST EMBANKMENT of Clark Hill project on Savannah River, 23 miles above Augusta, Ga., are members of Walter E. Rowe Student Chapter at University of South Carolina.

PNEUMATIC DRILLS IN OPERATION inside cofferdam at Clark Hill Project on Savannah River near Augusta, Ga., are inspected by Student Chapter members from University of South Carolina on recent visit. Holes are drilled in weathered rock for blasting.

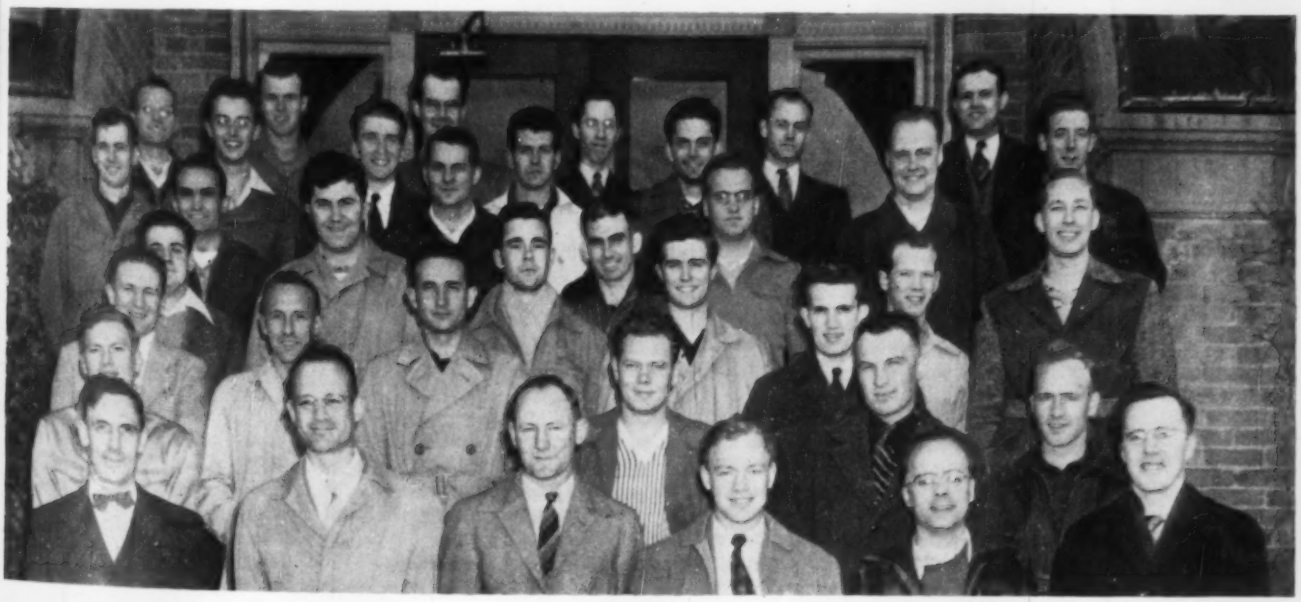


OHIO STATE UNIVERSITY

OHIO STATE UNIVERSITY STUDENT CHAPTER, pictured here, has record membership. Left to right, front row: James Elmer, Jerome Steltenpohl, Gerald Neumann, Roderick Tipton, Clifford Bemiller, Clifford Birdsall, Alvin Sturm, William Anderson, Abba Lichtenstein, and Jay Gilmore; second row, left to right, James Legas, John Schenk, Donald Freidman, Defro Tossey, secretary-treasurer, Paul Churto president, Armond Gustaferro, vice-president, Donald Lindimore, and Robert Pfieffer; third row, left to right, Edward Long, John Reinhard, Thomas Walker, Preston Daily, Fred Vogel, Robert Taylor, Charles Evans, Frank Jones, John Baker, Lewis Cole, Ray Weisent, William Woods, Chester Sarver, Fred Laughton, William Church, and Mary Kozaki; fourth row, left to right, Robert Witenhafer, Lester Herr, Howard Schuster, Louis Troglia, Kenneth Hall, William Cargo, Walter Samuelson, Morton Walker, Harold Mumaw, Robert Lucas, David Cook, Carl Edwards, Raymond Grover, John Atkins, Robert Biggert, and Arthur Carlucci.

UNIVERSITY OF IDAHO

AN INSPECTION OF construction operations and design features of the Columbia River valley irrigation project being built by the Bureau of Reclamation was made recently by the University of Idaho Student Chapter. The trip included an inspection of the dam and powerhouse of Grand Coulee on the Columbia River and a joint dinner meeting with the Student Chapter of Washington State College and the Spokane Section of the Society. The speaker of the evening was ASCE Western Representative Walter E. Jessup, who discussed the EJC report "The Engineering Profession in Transition." Officers of the Chapter during the past year have been Frank Larson, president; Doyle Jensen, vice-president; Robert Griffiths, secretary-treasurer, and G. A. Riedesel, faculty adviser. The chapter reports the conclusion of an interesting school year.



UPPER CLASSMEN of University of Idaho Student Chapter and faculty members are pictured here on steps of engineering building.

NEWS BRIEFS

Chicago Road Show Reviews Highway Construction History

PRESENT, PAST AND future development of highway construction in the United States will be graphically depicted in exhibits designed to show certain truths about road construction which are difficult to assimilate through discussion alone, when the 31st American Road Builders' Association Road Show opens at Soldier Field, Chicago, July 16. The show, held concurrently with the ARBA 45th Annual Convention at the Stevens Hotel, Chicago, will continue through July 24. Covering an area of more than 1,250,000 sq ft, this first postwar Road Show with its $15,000,000 worth of exhibits will be visited by more than 100,000 experts in all phases of road building.

Several displays of current, old time and prospective highway construction are under the auspices of the Public Roads Administration, with Thomas H. MacDonald, Hon. M. ASCE, commissioner of PRA, in charge. These displays, planned as guides to road builders and road officials, will be of particular value to engineers, contractors and materials men. One dealing with city traffic problems gives the spectator a graphic picture of results obtained from good traffic handling. Two models of a city, with the streets marked by strips of illuminated plastic, will be mounted on a revolving stage. Comparisons of the traffic problems before and after they have been dealt with will be noted as the two models interchange.

Another outstanding display on traffic is a mechanical device illustrating how much more safely and efficiently traffic flows along expressways than on city streets. In the latter exhibit steel balls represent motor vehicles as they travel down a ramp some 20 ft long. Comparative figures of the amount of traffic handled in the contrasting systems will be tabulated for the spectators' information.

Oil paintings, maps, dioramas, motion pictures, and panels will be included in the PRA exhibit to enlighten visitors on the history of road building.

More than 1,000 engineers representing 40 foreign nations are expected for the show and convention, to mark a new high in foreign attendance for the 39 years of Road Show history. Progress made during the past eight years by American engineering genius in developing equipment to carry out the greatest construction program in history more economically and more efficiently will be emphasized for the benefit of foreign visitors. Because of the war and reconversion problems, no road show has been held during this eight-year period.

Particularly large delegations from England, France, the Netherlands, and Latin American countries are registered for the show, with the largest single delegation expected from Canada. An international committee of 150 road builders, headed by Wesley M. Polk, M. ASCE, chief highway engineer of Illinois, is completing plans for reception and entertainment of the foreign visitors. An international section has been established at both the hotel and at Soldier Field where visitors will be welcomed in their own languages, provided with guides and entertainment. International technical sessions have been planned to give road builders from other lands a comprehensive view of American machinery and methods. Saturday, July 17, has been designated International Day at the show with foreign visitors to be welcomed by federal, state and city leaders.

From its modest beginning in Columbus, Ohio, in 1909, attended by 1,000 persons viewing the work of 40 manufacturers, in an area of 40,000 sq. ft, the Road Show has expanded to occupy more than 30 times that space, and the number of exhibitors has increased 750 percent. One theme, constant through all Road Shows, will be given added emphasis at this year's display. It is that the show shall be an educational force in highway and airport engineering. The 1948 show will symbolize the marked advances in road building. It will provide technical information on every detail of construction, maintenance and operation for engineers and officials. It will also have much educational value for the vast army of people who do not realize the importance of highway transportation in our national economy.

Road Show previews of equipment are shown on page 112 of the June 1948 issue of CIVIL ENGINEERING and on page 100 of this issue.

ASCE to Have Booth at Road Show

THE SOCIETY HAS arranged to have a booth in the Educational Exhibits section of the Road Show. Featured will be publications of the Society—"Civil Engineering," "Proceedings," "Transactions," manuals, and pamphlets. Members of the Illinois Section, including many Juniors, will be in charge of the booth.

Progress Is Reported in Continuing Highway Safety Action Program

SUCCESS IN REDUCING highway traffic fatalities both at home and abroad was reported by Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator and general chairman of the President's Highway Safety Conference, at a meeting of the Committee on Conference Reports, held in Chicago on June 15. In a review of the Action Program of the President's Highway Safety Conference, General Fleming stated that the fatality rate in the United States per 100 million vehicle miles was reduced from above 12 in the early months of 1946 to 8.6 for the year 1947. Furthermore, the rate was cut to 7.7 in the first three months of the current year.

In all foreign countries occupied by United States troops also, according to General Fleming, the Action Program has been instrumental in reducing fatalities. Its principles have been applied with marked success in South Africa, the Philippines, Canada, New Zealand, and Australia, as well as in Japan, Germany, and other countries. The Army's safety program, based on the Action Program, is required practice in all commands. It covers driver selection and training, investigation and reporting accidents, vehicle maintenance, enforcement and central records.

Similarly encouraging results were reported for the Air Force and the Navy, which cut its traffic fatalities 75 percent in 1947 as compared with 1946—"a direct result of the order requiring all drivers to take a special examination for driving skill and fitness." Preventive programs have also been adopted with considerable success by a number of government agencies, such as the Tennessee Valley Authority and the War Assets Administration, according to General Fleming. However, he warned that, despite the progress being made in this phase of the traffic safety campaign, "the gains are neither as widespread nor as complete as they should be."

The Action Program of the President's Highway Safety Conference was organized at the time of the first conference in 1946. The most recent President's Highway Safety Conference was held in Washington in June 1947 (CIVIL ENGINEERING for April 1947, page 56), with Executive Secretary William N. Carey and Past-President W. W. Horner representing the Society.

Public Construction Activity Shows Strong Seasonal Upturn

IN A SUMMARY of construction trends, reported in a recent issue of *Public Construction*, the Federal Works Agency states that public construction work put in place continued to increase in April to a January–April total of $885 million, more than 20 percent above the level of the same months in 1947. Increased federal construction, particularly on veterans' hospital and conservation and development projects, and accelerated state-local activity on school and other nonresidential buildings and sewer and water projects, were important factors in the improvement for the January–April 1948 period. Public construction activity accounted for 22 percent of the April total, slightly less than in April 1947.

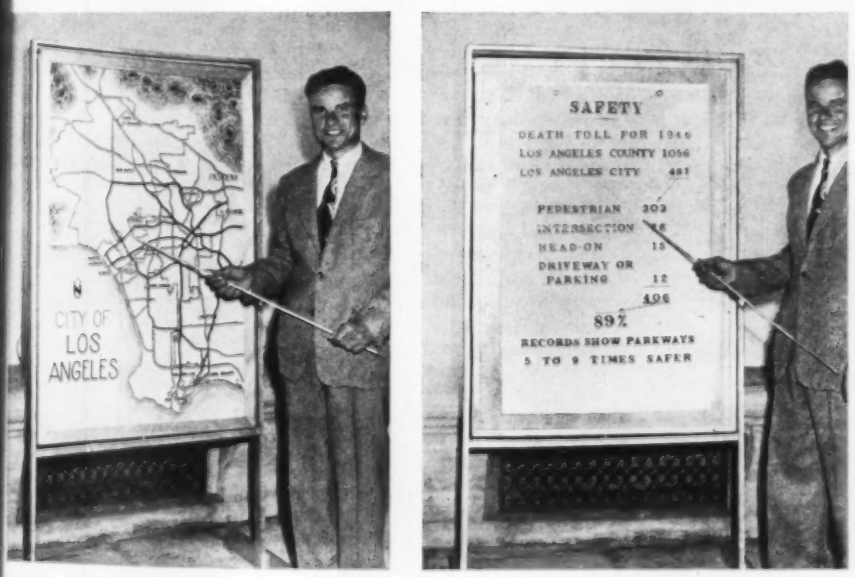
Private construction activity for April showed a smaller seasonal expansion than did public work. Residential building was up moderately to $500 million for the month, while nonresidential building declined slightly to $263 million. Revised estimates show that total private construction activity during the first four months of the current year totaled $3.7 billion, or nearly a billion dollars more than was recorded in the same period in 1947.

New public construction activity in April continued to expand seasonally, 24 percent, to a total of $279 million, according to preliminary data furnished by the Departments of Commerce and Labor. This increase was 30 percent over that reported for April 1947. All principal types of public construction showed gains in April, led by highway construction—up 54 percent to $80 million. More moderate increases occurred for military work (up 19 percent to $19 million), sewer and water facility construction (up 15 percent to $38 million), nonresidential building (up 14 percent to $74 million), and conservation and development (up 11 percent to $39 million). All of these fields of construction (notably nonresidential building) recorded higher levels of activity than in April 1947. Total public construction activity for the first four months of the current year, $885 million, was 22 percent more than the total of $726 million for the same period a year ago.

Public construction in April increased at a more rapid rate than private work for the second successive month, accounting for 22 percent of the total April work, as compared with 17 percent in February and 23 percent in April a year ago. Private operations in the residential field showed a small increase (5 percent) to $500 million, but were 61 percent above the level of a year ago. Nonresidential building was down fractionally to $263 million, with industrial building continuing a slow decline. Utilities work was up seasonally to $190 million, and farm construction increased to $37 million.

By source of funds, federal construction activity increased 20 percent in April to a total of $89 million, as compared with $84 million in the same month a year ago. State-local outlays were up 26 percent to $190 million, or 45 percent more than comparable expenditures in April 1947.

Device Proves Effective Means for Graphical Presentation



INGENIOUS DEVICE CONTRIVED BY CHARLES F. FORESTER, member of ASCE Student Chapter at California Institute of Technology, provided means for graphic presentation of data supplementing his paper on "Parkways in the Los Angeles Metropolitan Area," which was awarded first prize at recent Fresno Conference (CIVIL ENGINEERING for June, page 57). As simple as it is effective, device consists of frame-supported panel pivoted at center about vertical axis. Aid places transparent overlays over simplified base map while speaker explains series of charts (right), which are tacked on reverse side of panel in course of talk. Speaker's alternate display of overlays and statistical summaries received much favorable comment and proved welcome relief from conventional lantern slides.

Construction Roundup

From the Construction Industry Information Committee—Washington, D.C.

THE CONSTRUCTION INDUSTRY appears to be on the threshold of the greatest period of technological progress in its history, in the opinion of industry economists.

Its efficiency has been making unprecedented gains through the use of new and improved materials and equipment; widespread action to revise outmoded building codes; and the bringing of labor practices in closer accord with modern building techniques.

Many international unions have moved to eliminate ingrained industrial practices that have retarded technical progress. Restrictions on the number of apprentices have been greatly relaxed. Cooperative machinery has been set up to settle jurisdictional disputes.

Efforts to modernize building codes as a means of reducing construction costs are making better progress than at any time in the past and better facilities are now available for solution of the building code problem.

Efficient use of efficient materials has now reached a point at which real results can be seen; and this kind of progress, to the economists, means the dawn of an era more important than the period that brought in the steel frame, reinforced concrete, insulation, and the improvements in heating, lighting, and ventilating that changed the whole aspect of American building.

A far wider range of power equipment and general mechanization can now be applied to construction, even on the smaller-scale operations, than ever before.

N.Y. Transit Fare Increase Causes Many Station Changes

MECHANICAL CHANGES ESSENTIAL to rapid transit operation under the higher fare schedules which went into effect June 30 in New York City have been completed with removal of barriers separating the three subway divisions, opening of 14 new transfer points, in addition to five previously in operation, and installation of new booths for the sale of transfers between subway and city-operated surface lines. Slight changes in turnstiles to permit taking of dimes instead of nickels, and relocation of change booths with their electric wiring and telephone connections, to expedite traffic, also were necessitated by the change-over.

Passengers on surface lines now pay seven-cent fares and buy transfers to subways for an additional five cents for continuous trips. A passenger entering the subway now pays a ten-cent fare and buys a transfer to the surface line for an additional two cents.

Privately operated bus and trolley lines are not included in the new transfer arrangements which apply only to city-operated transit facilities.

United Effort Is Needed to Curb Building Costs

TO EFFECT ECONOMIES and to meet unwarranted criticism of progress in the construction field, Theodore I. Coe, technical secretary of the American Institute of Architects, recently called on the American building industry to unite its efforts. The industry, he said, has "been criticized for failing to accomplish the impossible. In the midst of rising costs in every category of our domestic economy the industry has been held responsible for its failure to maintain prewar prices in the single field of construction."

Whispers of discontent at increases in prices generally, he said, have become a roar of criticism when applied to construction, notwithstanding the fact that construction costs generally have risen less than other costs.

"The fact that the value of raw materials in the mine and forest represents but a small part of their cost when fabricated into actual structures is often not appreciated," he said, "and the fact that the absence of construction to meet civilian needs during the war emergency resulted in a huge back-log of demand, particularly in the field of housing, brought into play the inescapable law of supply and demand, with the results to be expected whenever demand exceeds supply."

Local organizations developed to meet local conditions, cooperation in effecting economies of construction, maximum productivity, and the seeking out of and application of technological developments and advances which serve to reduce costs were some of the solutions suggested by the speaker.

Construction Equipment Men See Business at High Level

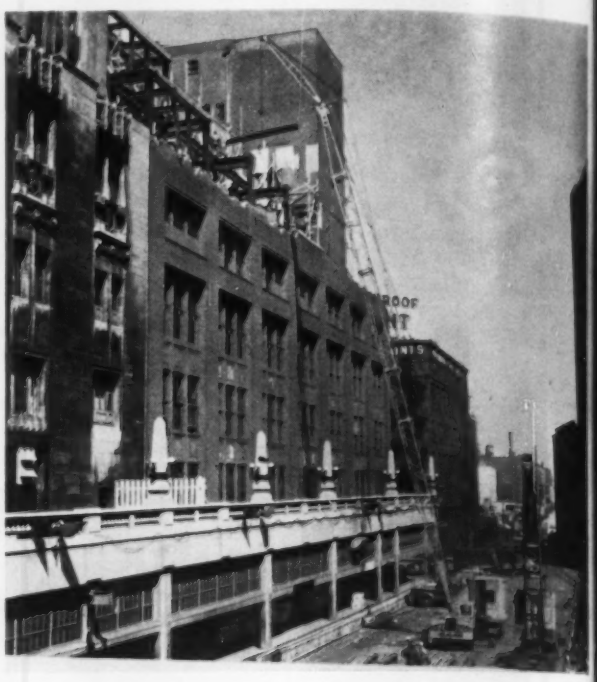
DISTRIBUTORS OF CONSTRUCTION equipment throughout the United States are uniformly optimistic that business will remain at a continued high level throughout the remainder of 1948, a recent nationwide survey conducted by Associated Equipment Distributors among its members reveals. A. F. Garlinghouse, Assoc. M. ASCE, president of the distributors' organization, reported results of the survey at a recent regional meeting of members of AED from five southeastern states at Atlanta, Ga.

Except for railroads, contracts are now being awarded for municipal, state, and other work in rather substantial volume. Railroads were reported comparatively inactive during the first quarter of 1948 in awarding construction contracts in eleven states, and the state road program was reported as disappointing in New York and New Jersey and as lagging in four Southwestern states. Elsewhere, however, distributors reported that contracts are being awarded in all classifications, with large industrial expansions increasing the total volume considerably in some states.

Contractors were reported generally busy throughout the nation at the end of the first quarter of the year, with an expectancy of increased work during the summer months.

Truck Cranes Team Up for Six-Story Lift

TEAMWORK BETWEEN TWO TRUCK CRANES provides simple means for placing steel for additional office space on setbacks of building adjoining Chicago Tribune Tower. Crane (right), with all-purpose boom, supplies structural steel members from adjacent parking lot, moving them into position. Second truck crane, equipped with 100-ft boom and 20-ft jib, lifts steel into place above sixth floor of building. Equipment similar to P&H 255-A truck cranes used on this job will be exhibited at Chicago Road Show.



Building Shortages Emphasize Importance of Fire Prevention

IN VIEW OF the pressing need for buildings of all sorts, fire losses today are little short of a calamity, according to W. E. Reynolds, M. ASCE, commissioner of the Public Buildings Administration, Federal Works Agency, and chairman of the Continuing Committee of the President's Conference on Fire Prevention. In recent addresses before Governors' Fire Prevention Conferences, reported in the May 1948 issue of *Public Construction*, Mr. Reynolds has emphasized the fact that replacement of burned property at current high construction costs imposes an extra burden on the property owner. "Anyway you look at it," he said, "fire prevention becomes a matter of national and local well-being."

Urging adoption of new building codes or revision of existing codes to incorporate adequate provisions for fire protection, Mr. Reynolds stated that some "existing statutes and local building codes would do a good job if there were properly qualified officials to enforce them," and recommended that immediate studies be made of administrative and enforcement staffs in all cities and states to determine their adequacy for the job of enforcement.

To meet the fire problem in federal buildings, he pointed out, a Federal Fire Council —made up of representatives of 35 federal agencies connected with the design, construction, or maintenance of buildings—was established some years ago by executive order. The council is constantly studying the fire problem and recommending preventive measures to be put into effect by government agencies. Mr. Reynolds also cited accomplishments of the Continuing Committee, established following the President's Conference on Fire Prevention in Washington, D.C., in May 1947, which has sponsored conferences on fire prevention in a number of states.

Far East Road Congress Meets for Annual Session

TECHNICAL PAPERS, PANEL discussions, and inspection trips made up the six-day meeting of the Indian Roads Congress, which held its 12th annual convention recently at Roorkee, India, with 250 delegates from provinces and states of India attending.

Among subjects of papers read before the Congress were; "Low Cost Roads for the East," "Track Spreading," "Standard Form for Recording Data on Cement Concrete Surfaces," "The Effect of Road Camber on Road Maintenance and Wheel Design," and "Effect of the Physico-Chemical Properties of Soils on Road Performance."

Included in panel discussions were papers on road subjects by members of the Indian Road Engineers delegations which visited the United States and the United Kingdom in 1946 and 1947.

An engineering exhibition on display at convention headquarters during the meeting was arranged jointly by the Congress, the Office of the Consulting Engineer to the Government of India, and several commercial groups.

Testing Materials Group Names ASCE Members for New Officers

RICHARD L. TEMPLIN, M. ASCE, assistant director of research and chief engineer of tests for the Aluminum Company of America, is the newly elected president of the American Society for Testing Materials. Mr. Templin, whose home is in New Kensington, Pa., was named at the organization's 51st annual meeting recently in Detroit, Mich. L. J. Markwardt, M. ASCE, assistant director, U.S. Forest Products Laboratory, Madison, Wis., was named vice-president for a two-year term, and Theodore P. Dresser, Jr., Assoc. M. ASCE, chief engineer of Abbot A. Hanks, Inc., San Francisco, was named a member of the board of directors for a three-year period. Other board members, chosen for a similar time, include Leslie C. Beard, Jr., and Simon Collier, both of New York; Howard K. Nason and Edgar W. Frasiz, both of Dayton, Ohio.

R. L. Templin

Engineering Staff Proposed for New Air Defense Group

RECOMMENDATION THAT A "highly qualified engineering staff charged with translating the broad requirements set up into technical specifications" was proposed recently by a committee on air navigation established jointly by the Secretaries of Defense and Commerce. The purpose of the group is to develop a single basic system of air navigation and traffic control that will meet the needs of civil and military users. Representatives from the Navy, Air Force, and CAA will make up membership of the proposed Air Navigation Development Board.

The engineering staff would develop projects which would be executed on a contractual basis by universities and commercial laboratories and through special arrangements with other government facilities to provide for coordination of the military program for air defense with the overall air navigation program.

ASCE Men Honored for War Services to Armed Forces

TWO ASCE MEMBERS are among recent recipients of the Medal of Merit in recognition of their outstanding services to the armed forces through their work in the wartime Office of Scientific Research and Development. Announcement of the awards was made by Secretary of Defense James Forrestal. Members of the Society honored are Dr. Robert Raynolds McMath, of the McMath-Hulbest Observatory, University of Michigan, and Edward Leyburn Moreland, of Massachusetts Institute of Technology.

New Western Construction Projects Announced by Reclamation Bureau

UNDER THE TITLE of "Bid Calls Expected This Month," the Bureau of Reclamation in its *Advance Construction Bulletin* for June 1 lists work about to begin on several large Western construction projects. Although the bulletin emphasizes that all information published is subject to revision, the data given will provide an indication of the nature, size, and location of proposed reclamation projects.

EARTHFILL DAM

Paonia Project, Colorado

Location: On East Muddy Creek about 20 miles northeast of Paonia, Colo.

Work: Construction of Spring Creek Dam, an earthfill structure approximately 130 ft high and 1,300 ft long.

Excavation (all classes)	1,000,000 cu yd
Tunnel excavation	40,000 cu yd
Earthfill	625,000 cu yd
Rockfill	80,000 cu yd
Riprap	36,000 cu yd
Concrete	6,000 cu yd
Steel tunnel supports	200,000 lb
Time Allowed for Completion:	900 days

PIPELINES

Coachella Division, All-American Canal California

Location: Near Mecca, Calif.

Work: Construction of concrete pipelines and structures for Unit No. 5 of Coachella Valley distribution system.

Furnishing and placing 10 to 72-in. diameter concrete pipe	51 miles
Excavation	247,000 cu yd
Concrete	885 cu yd
Furnishing and placing reinforcing steel	92,000 lb
Installing pumping units and valves	37,510 lb
Time Allowed for Completion:	550 days

CANALS AND LATERALS

Riverton Project, Wyoming

Location: About 20 miles northeast of Riverton, Wyo.

Work: Construction of earthwork, tunnel, and structures for Wyoming Canal from Station 1606 to Station 2560. Construction of earthwork and structures for Muddy Ridge Canal from Station 0 to Station 20, including laterals, sublaterals, and wasteway.

Excavation for canals and structures	1,800,000 cu yd
Excavation for tunnel	20,000 cu yd
Installing gates and metalwork	63,000 lb
Concrete	8,600 cu yd
Time Allowed for Completion:	550 days

PIPELINES AND STRUCTURES

Provo River Project, Utah

Location: Near Provo, Utah

Work: Construction of concrete pipeline and structures.

Excavation for pipe trench	102,400 cu yd
Excavation for structures	17,500 cu yd
Benching for pipeline construction	279,300 cu yd
Furnishing and placing 69-in. diameter concrete pipe	24,520 ft
Concrete in structures	1,300 cu yd
Concrete in foundation of pipeline	1,830 cu yd
Time Allowed for Completion:	500 days

Reserve Volunteers Sign for Corps of Engineers

ADMINISTERING OATH OF ENLISTMENT TO RESERVISTS volunteering for assignment with 434th Engineer Construction Battalion, sponsored as reserve unit by Corps of Engineers, is Lt. Col. Ralph D. King, Assoc. M. ASCE (right), director of Waterways Experiment Station, Vicksburg, Miss. Organization of 434th unit as part of organized Reserve Corps follows present Army policy of building Engineer Reserve units around groups of trained engineers and technicians who have worked together or are working together on civilian jobs comparable to their probable Army duties in emergency. Others in photograph, left to right, are Lt. Col. Eugene P. Fortson, Jr., M. ASCE, Engineer Reserve, commanding officer of battalion; Staff Sgt. E. S. Melsheimer; Master Sgt. H. E. Wright; First Sgt. R. M. Rudd, and Staff Sgt. C. J. Powell.

OIC Promotes Full Production of Scarce Goods and Materials

THE OFFICE OF Industry Cooperation in the Department of Commerce is moving ahead on many fronts in the general industrial area, with the objective of breaking road-blocks impeding full production of scarce goods and materials, which basically affect industrial output or the cost of living. The OIC staff has held 28 meetings with businessmen to discuss their industry's participation in the Voluntary Industry Agreements Program authorized by Public Law 395, which was passed by the Eightieth Congress.

As a result of these meetings, the Secretary of Commerce up to May 10, had appointed members to 16 Industry Advisory Committees, composed of representatives of large, medium, and small businesses in each industry, for the purpose of participating or considering participation in the Voluntary Agreements Program.

Advisory committees have been formed to represent the following industries engaged in producing or distributing end-products in critically short supply: Steel products, general steel distributors, merchant steel products distributors, freight cars, and agricultural equipment. For housing construction, the following divisions are represented: Cast-iron soil pipe, cast-iron pressure pipe, warm air furnaces, plumbing drainage supplies, softwood plywood, all-steel manufactured houses, cast-iron enamelware plumbing, and cast-iron low pressure boilers.

Advisory committees representing industries producing basic materials which are essential to full production of these end-products are actively participating in the Voluntary Agreements Program. These committees represent industries producing the following basic materials: steel, pig iron, soda ash, and caustic soda.

Output Meeting Demand in Several Lines, Producers Hear

PRODUCTION OF MANY materials, such as clay products, cement block, structural grades of lumber, and most plumbing and heating items has reached the point where output has overtaken demand, David S. Miller, president of the Producers' Council, told the organization's newly formed New Orleans chapter at a recent meeting.

The only materials likely to continue in tight supply, Mr. Miller pointed out, are millwork and items made of iron and steel. These conclusions, he added, are based on the assumption that there will be no work stoppages of major proportions related to construction and no further diversions of raw materials to war production on a larger scale.

Dealers' inventories of materials have been increasing steadily, Mr. Miller added, and further increases are expected.

ASCE Honorary Member Judge in High School Driver Contest

THOMAS H. MACDONALD, HON. M. ASCE, commissioner of the Public Roads Administration, has been named one of eleven judges for the high school driver education award program of the Association of Casualty and Surety Companies. The judges will evaluate annual reports submitted by states on progress achieved in the development of high school driver education courses.

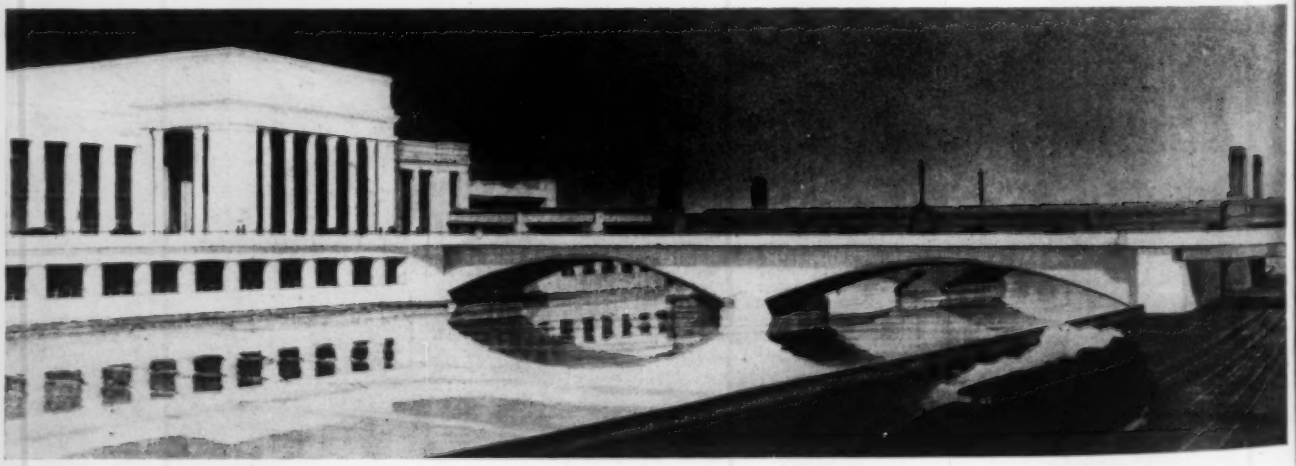
The high school driver education award program was initiated this year by the Association of Casualty & Surety Companies Accident Prevention Department. Each state participating is eligible for one of three awards. Special representatives designated by state governors have submitted reports on the school year just ended for review at a meeting of the board of judges in Chicago.

Plans Approved for Extensive Philadelphia Improvements

REPRESENTING THE COOPERATIVE effort of five major enterprises, including city and state organizations and the Pennsylvania Railroad, plans for the construction of Pennsylvania Boulevard, Philadelphia, a new highway calling for a total expenditure of $35,000,000 and approximately five years of work, have been approved by the Philadelphia City Planning Commission, according to a recent announcement of its chairman, Edward Hopkinson.

The new boulevard will extend from Reyburn Plaza to the 30th Street Station of the Pennsylvania line, with the railroad's share of the total cost amounting to $20,000,000. The remaining $15,000,000 expense will be shared by the city and state. Project plans, representing more than a year of intensive study by the commission's consultants, Clarke, Rapuano and Holleran of New York, record the results of a cooperative study by the Philadelphia Department of Public Works and the city's transportation company, the Pennsylvania State Highway Department, the Planning Commission and the Pennsylvania Railroad.

Thomas Buckley, M. ASCE, director of the Department of Public Works, announced recently that working drawings for the section of the highway west of the 30th Street Station will be started immediately and that actual work will begin early in 1949. Plans for the boulevard include removal of the elevated railroad to the Broad Street Station and the station itself to make room for erection of new buildings in the Triangle area between the Schuylkill, Benjamin Franklin Parkway, and Market Street. Present plans call for work on the eastern section of the proposed boulevard and a bridge across the river at 30th Street immediately following the construction of additional tracks and facilities by the railroad at other points to handle trains now using the Broad Street Station.



PROPOSED BRIDGE ACROSS SCHUYLKILL RIVER at 30th Street Station of Pennsylvania Railroad in Philadelphia will be ready for automobile traffic about 1953. Four-lane, reinforced concrete arch structure is part of new Pennsylvania Boulevard project, which will cost city, state, and Pennsylvania Railroad total of $35,000,000.

Member, Studying Nights, Completes College Course

FOR 16 YEARS John Ellison Lane, Assoc. M. ASCE, has been doing construction work by day and, off and on by night, studying at New York University for a degree in civil engineering.

At the age of 51 he received his degree recently at the university's 116th commencement. Mr. Lane, whose home is in Brooklyn, entered the university in 1932 with the intention of taking some courses in higher mathematics. Later he decided to study for his engineering degree. He began his career in 1918 in private construction work, planning, designing and directing construction of apartment houses, business properties, office buildings, garages and small dwellings. From 1929 to 1934 he was construction superintendent for the State Title and Mortgage Co., New York, directing construction for completion of foreclosed properties in New York suburbs, including a development of 200 buildings involving the construction of sewer and street systems, and the completion of brick work. As property rehabilitation supervisor and real estate appraiser, Mr. Lane was with the Bureau of Rehabilitation in the State of New York Insurance Department from 1935 to 1940 when he resumed private practice. He joined the Society in 1941. His son, Stanley, is a sophomore in the N.Y.U. college of engineering.

New York Waives Written Engineering Examination

UNDER CERTAIN CIRCUMSTANCES the New York State Board of Examiners for Professional Engineers and Land Surveyors will waive the requirement of written examinations. Those exempt are: (1) Applicants who have passed an equivalent written examination for registration in another state, and (2) applicants of long established and recognized standing in the engineering profession who have practiced lawfully for more than 15 years.

FPC Authorizes Construction of New Pipeline Facilities

AUTHORIZATION WAS RECENTLY granted by the Federal Power Commission to the Texas Eastern Transmission Corp. for a temporary certificate permitting initiation of construction of new facilities pending FPC hearings for a permanent certificate. Proposed increased capacity of the corporation's Big and Little Inch pipelines will augment its natural gas delivery to 508,000,000 cu ft per day by the beginning of 1949. This figure represents an increase of 75,000,000 cu ft daily over the delivery rate originally planned by the company by the end of 1948. (See CIVIL ENGINEERING, April 1948, pp. 58-59.)

Increasing requirements of the Inch Lines will be made through purchase of casinghead or flare gas, ordinarily wasted for lack of an available market, in the amount of 55,000,000 cu ft daily from three Texas fields. Work has already begun on installation of additional compressors aggregating 86,400 hp, and a total of 239,900 compressor hp will be installed by the beginning of the coming year.

Immediate construction of three new gathering lines is planned by the company. Twenty miles of 8-in. pipeline will be built in Texas; two 10-in. lines, one five miles and the other two miles long, will be laid in Louisiana. Another 10-in. line extension, running 17.2 miles from the Little Big Inch to the Silsbee field in Texas, will be started late this year.

Total capital cost of the proposed system is about $182,700,000.

Engineering Skills Called Vital to Solution of Problems in Atomic Energy Research

IF THE UNITED STATES is to retain its preeminent position in the field of atomic energy research "know-how," it is "highly essential that the number of technical people in that field be greatly expanded" Dr. O. C. Simpson, associate director of the chemical division, Argonne National Laboratory, Chicago, told members of the ASME at their semiannual meeting in Milwaukee, Wis., recently.

Dr. Simpson called upon the nation's engineers to turn their professional skills to the solution of many problems of atomic energy research. Large general problems confronting engineers include, according to the speaker, the design and construction of a "more versatile" 60-in. (magnet) cyclotron in which the type of bombarding particle and its energy can be changed at will; the design of a nuclear reactor for the production of useful power, including the development of a high temperature refractory, such as ceramic materials, for use in place of metals; the engineering of simpler, cheaper, and more versatile apparatus for isotopic separation work; remote control engineering which "may be the most important single field in the future development of atomic energy." This would include an "automaton" with apparatus to carry on operations in an airtight structure heavily shielded against the deadly radiation damage.

Other major issues confronting engineers in connection with atomic research, Dr. Simpson said, include problems of shielding which "will play a major role in any use of a nuclear reactor as a mobile power source"; air conditioning and ventilation of radiochemical laboratories, necessary for use with hazardous gases or radioactive particles of matter; new chemical problems which have arisen in dealing with radioactivity, and finally a problem important not only to atomic researchers, "but to every human being, of active waste disposal—sanitation engineering for the atomic age."

Forrest Nagler, M. ASCE, chief engineer, Allis-Chalmers Mfg. Co., Milwaukee, was elected vice-president at the Milwaukee meeting of ASME. Other officers chosen at the meeting are: James M. Todd, New Orleans, president; Albert R. Mumford, New York, Arthur Roberts, Jr., Lynchburg, Va., and Carl J. Eckhardt, Austin, Tex., vice-presidents; J. A. Keeth, Kansas City, Mo., and Ralph A. Sherman, Columbus, Ohio, directors.

Heavy Transformer Is Placed Without Aid of Crane

HUGE SINGLE-PHASE TRANSFORMERS, installed recently at Snohomish Substation of Bonneville Power Administration after shipment across continent, are righted by means of simple tools available at site. Skillful use of diesel winches, block and tackle, jacks, and cribbing, proves expedient in raising 83,333-kva Westinghouse unit from horizontal position.

Inter-American Engineers Hold First Meeting in Chile

WITH 1,300 ACTIVE MEMBERS representing 21 republics of the Western Hemisphere, the Inter-American Association of Sanitary Engineering has been placed on a permanent basis and provided with its initial panel of elected officers following the group's first meeting at the University of Chile, Santiago, recently. More than 250 members from 19 of the Republics attended the Congress. Mexico City was selected as the 1949 convention center.

Donald L. Snow, Jun. ASCE, sanitary engineer with the U.S. Public Health Service, assigned to the Pan American Sanitary Bureau's Lima, Peru, and Washington, D.C., offices, was elected as general secretary of the newly organized group. Other officers include Clarence I. Sterling, Jr., of the United States, president, and Alberto Ortiz Irigoyen of Mexico, vice-president. Ruperto Casanueva, Jun. ASCE, was chairman of the Chilean Section of the Inter-American Association of Sanitary Engineering arranging the meeting.

Papers on present and future programs of the national sanitary engineering departments in the various republics provided much of the first meeting's activity. Malaria control engineering problems occupied many of the sanitary engineers attending. A large industrial exhibit of equipment used in the sanitary engineering field permitted more than 20 manufacturers from the two continents to demonstrate their products. Several inspection trips were conducted to points of engineering interest in and around Santiago.

Multiple-Purpose Project Suggested to Control Floods

RECOMMENDATION FOR A Green River multiple-purpose storage project at Eagle Gorge to control floods in that area of the state of Washington recently was made by the district and division engineers, Corps of Engineers of the Army. The project, in addition to controlling floods "that may reasonably be expected to bankfull capacity," would provide other benefits in connection with navigation, the recommendation points out. Estimated federal cost of the improvement is $16,100,000, with no local contribution of funds required.

First of Safety Films Is Issued by Insurance Company

SAFETY MEASURES for prevention of accident causes on scaffolds, ladders, and floor openings are shown in a new film released by the public education department of the Aetna Casualty and Surety Co. This is the first of a projected series on construction safety to be issued by the company. The film, entitled "Scaffolds, Ladders and Floor Openings," is a 16-mm. one in color, with sound accompaniment, has a running time of nine minutes, and is particularly suited for showing to construction foremen and worker groups.

Prints may be obtained, free of charge, through any Aetna representative or by writing to the public education department, Aetna Casualty and Surety Co., Hartford, Conn.

In commenting on this, his 100th instalment since the column was initiated in the February 1940 issue of "Civil Engineering," N. G. Neare comments that he is now "even up with Boccaccio, but without hope of catching up with Scheherezade."—Editor

SEVERAL SEATTLE VISITORS attended the July meeting of the Engineers Club and put up quite a sales talk for their home town. They called it the Gateway City, because it was the nearest stateside port to Alaska and the Orient and predicted phenomenal growth of Seattle as these regions were industrialized. When they mentioned the proposed Seattle-Seoul Gravity Tunnel, Professor Neare detected a plot for a problem.

N. G. Neare

"We have to start with some 'ifs,'" he said. "If the earth was a homogeneous sphere at rest and if its temperature permitted driving a tunnel thru on a diameter and if there was no friction or air resistance, then a car dropped in one end would come to rest at the other in just 2,530 sec. In a tunnel on any other alignment, the kinetic energy of a car must be $mg/2R(R^2 - r^2)$, where m is the mass of the car, g is the acceleration due to gravity at the surface, R is the radius of the earth and r is the radial distance from the center of the earth to the car. Since this can't become zero until $r = R$ again, the car will keep moving in any tunnel until it reaches the end portal. With all these 'ifs,' how long must it take a car to 'fall' thru a tunnel from Seattle to Seoul, one-fifth the way around the earth?"

"I know, Professor," shouted Joe Kerr "It's. . . ."

"Hold it, Joe. That's for September. But you can talk to Guest Professor Justin Case about rectangles oblong by a foot, divided diagonally so that each half had a perimeter in even chains."

"I'd rather not, Professor Case, and I'll tell you why. It's a problem in integers to satisfy two equations: $x^2 + (x + 1)^2 = y^2$ and $x + (x + 1) + y = 66n$. It wasn't hard to find that x must end in 0, 3, 6 or 9, so I started adding consecutive squares in my tables and found that $3^2 + 4^2 = 5^2$, $20^2 + 21^2 = 29^2$, $119^2 + 120^2 = 169^2$ and $696^2 + 697^2 = 985^2$, but none of the perimeters 12, 70, 408, and 2,378 was divisible by 66."

"So you quit when you came to the end of the tables. I hope Cal Klater didn't use tables."

Meetings and Conferences

American Road Builders Association Convention and 1948 Road Show. The first Road Show in eight years will have the largest exposition of equipment, machinery and materials used in the construction of highways and airports ever staged. The ARBA's 45th annual convention will have its headquarters at the Stevens Hotel, Chicago. The Road Show will be at Soldier Field, Chicago, with exhibits taking up an area of 1,250,000 sq. ft. Dates for both the show and convention are July 16–24.

Institute of Traffic Engineers. The 19th annual meeting of the Institute of Traffic Engineers will be held at the Hotel Warwick, Philadelphia, October 11–13. Further information may be obtained from Robert S. Holmes, executive secretary, 212 Strathcona Hall, New Haven 11, Conn.

International Mechanical Engineering Congress. The Engineering Trade Associations of the principal industrial nations in Western Europe will sponsor a Congress in Paris, September 13–18. Manufacturers and research workers will attend and will consider the possibility of setting up international study groups.

National Technical Conference of the Illuminating Engineering Society. Latest developments and progress in the art and science of illumination will be discussed at the conference at the Hotel Statler in Boston, Mass., September 20–24. Papers will be presented on home and street lighting, light control, lighting installation, fluorescent lamps and allied topics.

Texas Traffic Engineering Conference. The second Texas Traffic Engineering Conference will be held at the Hogg Auditorium, University of Texas, Austin, July 7–9. Cooperating organizations are the Texas Highway Department, the League of Texas Municipalities, the Texas Safety Association, Inc., the Institute of Traffic Engineers, New Haven, Conn., and the Bureau of Highway Traffic, Yale University. Further information may be obtained from John A. Focht, professor of civil engineering, University of Texas, Austin, or M. V. Greer, supervising traffic engineer, Texas Highway Department, Austin.

Western Association of State Highway Officials. A conference of the organization will take place at the Multnomah Hotel, Portland, Ore., July 25–28.

"I used generators instead, Justin. In Cal's series of perimeters, six times any item is the sum of the two adjacent items, e.g., 6 × 70 = 12 + 408. This leads to the generating equation,

$$P_n = 6P_{n-1} - P_{n-2} \qquad (1)$$

Starting with the trivial $P_1 = 2$, divisibility of items of the series is recurrent, thus: $P = 3a$ when $n = 2b$; $P = 5c$ when $n = 4d$; $P = 11e$ when $n = 6f$ and $P = 2^k g$ when $n = 2^{k-1}h$. Using LCM's of the n's, $P_6 = 38,360$ ft $= 210\ ch$ and the rectangle was $4,059 \times 4,060$."

"And did you work it in miles, Cal?"

"Far enuf to see that it was out of this world. Since $5,280 = 3 \times 5 \times 11 \times 2^5$, the least perimeter is P_{48}, which has 37 digits."

"A matter of 63 quintillion light years, but to puzzlers the very real number 1,972,063,063,734,639,263,984,455,073,299,118,880. Anything to add, Noah?"

"Not to that number, Justin, but a word on computing. For any quadratic form, generators like (1) connect three consecutive solutions and these may be compounded to connect any three items at regular intervals. Now for every $n = 6m$ there is a solution in chains connected by $P_m = 39,202P_{m-1} - P_{m-2}$, and this implies the complete solution."

[*Cal Klaters were: Paul Seide, the anonymous A. Nuther Nutt, Richard Jenney, Carl H. Heilbron, Jr., and John L. (Stoop) Nagle —the last three adding the solutions in miles. Guest Professor Justin Case was Homer J. Gault.*]

NEW IN Education

TWO GIFTS TOTALLING $64,251 have been received by Columbia University for the establishment of scholarships in the school of engineering, according to recent announcement by the university. One bequest of $38,351 is in memory of Harry Benson Ryker, engineering student at the university who died in 1899, one year before graduation. It is to be used to aid engineering students of "ability, character and moderate means." The second bequest, in the amount of $25,900, will be used for scholarships.

* * * *

TO PROVIDE BOTH formal and practical insight into fundamentally effective techniques for persons with a background of experience and at least one course in statistics, quality control, or the equivalent, a five-day training conference in industrial experimentation will open at Columbia University, September 14. The course will be offered by the engineering school of the university under direction of three Columbia teachers and five industry specialists. Forenoon sessions will be devoted to the presentation of formal principles and problems, with afternoons set aside for clinic sessions at which specialists in industry will speak. The subject matter for each day will be treated as a unit. Further information may be had by writing to S. B. Littauer, Department of Industrial Engineering, Columbia University, New York 27, N.Y.

* * * *

EIGHT PROJECTS IN brick and tile research are nearing completion at seven university laboratories and the National Bureau of Standards. The principal objective of the projects is the development of new and improved structural clay products as part of a program being conducted under supervision of the Structural Clay Products Institute and the Industrial Research and Development Division, Office of Technical Services of the Department of Commerce. Such innovations as lighter weight brick and tile, precast tile beams, and more uniform and durable clay products appear commercially practical from early conclusions regarding the projects which are being carried on at the Universities of Texas, Minnesota and Illinois, New York State College of Ceramics, North Carolina and Iowa State Colleges, Virginia Polytechnic Institute and the National Bureau of Standards.

* * * *

GRADUATE STUDY IN sanitary and public health engineering courses is combined with opportunity for part-time teaching and research assistantships at the University of Missouri. Additions to the traditional sanitary control of water supplies and sewage disposal include environmental control of gas, liquid and solid waste products, engineering control of atmospheric pollution, insect and rodent control, food and milk sanitation, and nation-wide stream pollution control activities. Further information may be obtained from the dean of the college of engineering at the university, Columbia, Mo.

* * * *

ENGINEERING STUDENTS AT THE University of Mississippi who are in the Army or Navy R.O.T.C. program will be allowed to carry the same number of hours as a regular engineering student during the last three years of a four-year course, beginning next fall. Announcement of the plan was made recently by Dean Lee H. Johnson, M. ASCE, of the engineering school. Previously, engineering students have taken a straight course with as few as three hours offered as electives. Under the modified program, in a move to meet the need of the armed forces for trained reserve officers with engineering degrees, military training may be substituted for some of the required courses for students in engineering. Under the new program, military and naval courses will be integrated with the engineering program in each of the four curricula in the school.

Surveying Teachers to Meet for Summer Camp Program

LEGAL ASPECTS OF surveying, statewide plane coordinate systems, and photogrammetry will be among subjects for study and discussion at the Fifth Regional Surveying Teachers Conference, August 26–28, at the Green Engineering Camp, owned and operated by Cooper Union, near Ringwood, N.J. The conference, first since 1940, is under the joint auspices of the institution and a committee of the civil engineering division of the American Society for Engineering Education. New developments in methods, equipment, and application, together with papers on several current aspects of surveying, will be studied.

Registration fee for the conference will be $15, which includes meals and lodging. Further information may be obtained by writing to John O. Eichler, school of engineering, the Cooper Union, New York 3, N.Y. The program committee in charge includes Professor Eichler, A. H. Holt, Philip Kissam, R. K. Palmer, and G. R. Shaw, all Members, ASCE.

Member Gives Commencement Address at Cooper Union

IN NINE DECADES of service, the Cooper Union has enabled thousands of men and women to enter upon a professional career which might otherwise have been denied them because their families could not afford to send them to college, John Charles Riedel, M. ASCE, chief engineer for the City of New York, told students at the annual spring commencement exercises at the institution of which he was a graduate in the class of 1898.

Mr. Riedel, who entered the service of the city 47 years ago, was at one time an instructor in the Cooper Union school of engineering. He emphasized, in his address, the fact that many important posts in the municipal service, including those of divisional engineer for the department of docks, chief engineer for the same department, chief engineer of the board of estimate, engineer in charge of design and many others vital in the city's service, are filled by men trained at Cooper Union.

Engineers from Illinois Tech Attend Annual Surveying Camp

SUMMER SURVEYING CAMP activities for Illinois Institute of Technology students are now in progress at Camp Armour on Upper Trout Lake, Wis., with three groups scheduled to take part in field practice at various periods up to September 3. The camp program at the Institute, now in its 41st year, is one of the oldest in the country. Civil engineering students at the Institute attend the camp during the summer before their junior or senior years, working in a large forest preserve for their surveying program.

Annual Davis Award Contest Announced by Welding Society

FIRST AND SECOND prizes of $200 and $150, respectively, will be given winners in the 1948–1949 A. F. Davis Undergraduate Welding Award of the American Welding Society. Equal awards will be presented to the publications (undergraduate paper or magazine) publishing the two winning papers. Designed to encourage and stimulate interest in welding through the preparation of articles on the subject of welding by undergraduate students, and dissemination of such information through undergraduate publications, the award is named for its donor, vice-president and secretary of the Lincoln Electric Co., Cleveland. Subject material for competing papers may be on any phase of any type of welding or its application to design and construction.

Any undergraduate of any college or university in the United States, its possessions, or Canada is eligible. The paper must be published in an undergraduate publication during the year beginning April 1, 1948. Further information may be had from the chairman of the educational committee, American Welding Society, 33 West 39th St., New York 18, N.Y.

First Traffic Session Set for Oregon State College

THE FIRST OREGON traffic engineering conference will be held at Oregon State College in Corvallis July 29–31, one of a series being conducted throughout the country under auspices of the Institute of Traffic Engineers and the Yale Bureau of Highway Traffic. The meeting, like others being held elsewhere, has a twofold purpose, to focus attention on the many problems confronting those responsible to the motoring public in providing the utmost in safe and expedient transportation facilities, and to bring to bear the best engineering talent and experience possible, looking to betterment of traffic conditions and a higher level of service to the motoring public.

Many aspects of traffic engineering and allied subjects will be covered, including factual survey techniques, street and roadway designs, intersectional channelization and control, signalization, traffic regulation, parking, mass transportation, one-way streets, signs and markings, regulations, and long-range planning.

Leading speakers and panel participants will include Wilbur Smith, Assoc. M. ASCE, associate director of the Yale Bureau of Highway Traffic, and Robert S. Holmes, Assoc. M. ASCE, executive secretary of the Institute of Traffic Engineers.

Index of Scholarship and Loan Funds Is Compiled

INFORMATION ON SCHOLARSHIPS, loan funds, and grants of some 130 colleges and universities, compiled by the Women's Committee of the Engineering Society of Cincinnati, will be available in mimeographed form in the early fall. Inquiries regarding the index, which will sell for $3, should be addressed to the Engineering Society of Cincinnati, McMillan at Woodburn, Cincinnati 6, Ohio.

Mrs. Robert C. Vogt was chairman of the Women's Committee in charge of the compilation.

Traffic Engineering to Be Studied at Annual Institute

OPERATING PROBLEMS ARISING from the movement of traffic on street and highway systems is one of several major subjects in the traffic engineering course at the Tenth National Institute for Traffic Training at Northwestern University, Evanston, Ill., this month. While courses are offered during various periods from July 12–29, the traffic engineering sessions are scheduled the first five days.

Other subjects include traffic surveys and studies, including volume, speed, origin and destination, and parking; design, application and use of traffic control devices, traffic rules, elements of traffic design, planning values of traffic studies, and the influence of traffic operation in planning modern traffic facilities. The course is open to engineers and assistants from city, county, state, and federal agencies dealing with street and highway development and improvements, or with street and highway traffic control and regulation, operating engineers with bus and transit companies, and persons responsible for preparation of community, city, or regional planning.

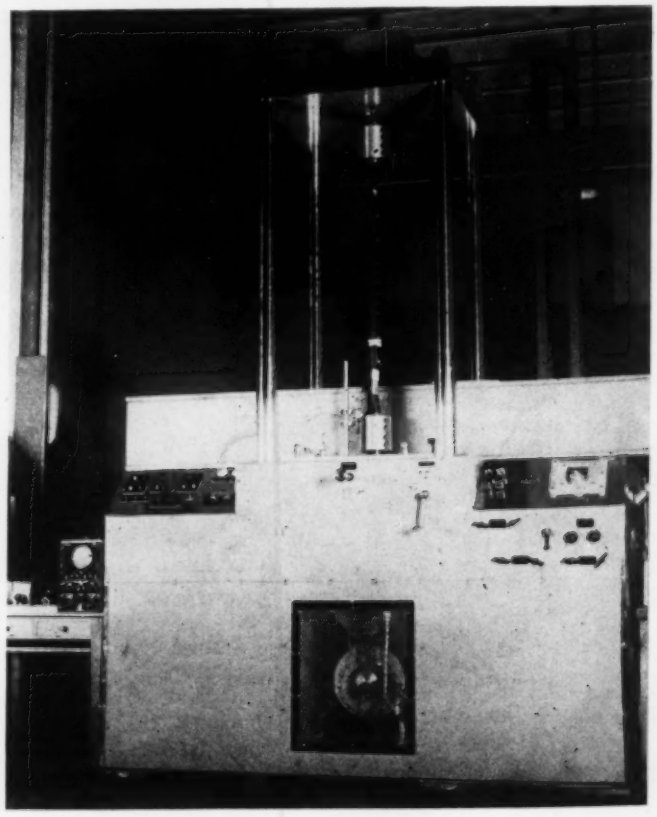
Stanley A. Abercrombie, 1201 Sixteenth St., N.W., Washington 6, D.C., is secretary of the National Committee for Traffic Training.

New Fatigue Testing Machine Developed at Purdue

AN AMAZING RANGE of versatility is achieved in a new fatigue-testing machine, recently installed in the Materials Testing Laboratory at Purdue University. Consisting of two powerful repeated-stress machines combined into one, the new machine has a hydraulic loading and measuring system which makes possible, through an electronic relay control, a cyclic speed range varying from 0 to 1,000 cycles per minute within a 5 percent loading accuracy. Special solenoid controlled values give an accurate load maintenance. The hydraulic ram is capable of delivering a force of 60,000 lb in tension, compression, cross-bending or twisting.

Four large columns supporting the top head make possible the testing in tension and compression of specimens up to 60 in. in length. Spans up to 8 ft 6 in. may be tested in flexure. Adjustable rocker supports, cross-clamped to prevent sidesway, hold the specimen. Transverse bending is accomplished by two rigid support beams clamped on the table, and twisting by offsetting the specimen and attaching a lever to the ram head.

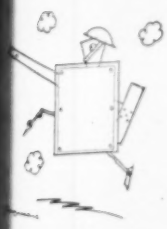
Collaborators on the specifications and design of the machine were Rolland G. Sturm, M. ASCE, professor of engineering mechanics at the university, and Glen N. Krouse, of the Krouse Testing Machine Co., Columbus, Ohio.



RESULTING STRESS PATTERN of riveted member under test in Krouse-Purdue machine is shown on oscillograph to left. Grilled opening in lower center of machine shows variable crank throw, which maintains cyclic rate in high speed (1,000 cycles per minute). Transverse beam on platform is one of two such beams used when flexural and twisting loads are applied.

War Exploits of British Civil Engineers Recorded

AUTHORITATIVE ARTICLES, DEALING with the accomplishments of the civil engineers of Great Britain in World War II, have been collected by the Institution of Civil Engineers of Great Britain and made available for distribution in the United States by the ASCE, which is glad to act as a subscription agent. Orders for the set, consisting of three volumes bound in stiff paper covers, will be filled directly from a supply maintained at Society Headquarters. The price of $8.50 per set includes postage. Single volumes are not available.



Totaling 1,400 pages, the series consists of 76 papers, with their discussions, and a thousand illustrations. The papers, which cover the whole civil engineering field from airfields to water supply and tunneling, discuss the wartime problems that arose, describe the methods of solution, and give the solutions a postwar application. Volume 1 discusses the subjects of airfields, roads, railways, and bridges; Volume 2, docks, harbors, and "mulberry"; and Volume 3, hydraulics, structures, surveying, and tunneling. Geographically, the projects treated cover the whole vast field of conflict—from Gibraltar to Singapore.

New Publications

Engineering Filing. A selected list of 41 references to books and articles on systems for the filing of notes, drawings, maps and other engineering data comprises a bibliography on engineering office filing recently issued by the Engineering Societies Library. Entitled *Filing Systems for Engineering Offices*, the publication may be obtained from the Library, 29 West 39th Street, New York 18, N.Y., at a cost of $2.

Structural Engineering. Engineers working with curved beams will find two new bulletins published by the University of Missouri helpful in making their stress computations. These are *Influence Lines for Horizontally Curved Fix-end Beams of Circular-Arc Plan* by Prof. Robert B. B. Moorman, M. ASCE, and *Stresses in a Uniformly Loaded Circular-Arc I-Beam*, co-authored by Professor Moorman and Manfred B. Tate, Jun. ASCE. Also available is an earlier study by Professor Moorman, entitled *A Semi-Graphical Method of Analysis for Horizontally Curved Beams*. All three bulletins may be obtained upon request from the Director of the Engineering Experiment Station at the University of Missouri, Columbia, Mo.

American Standards. An up-to-date list of 872 national standards approved by the American Standards Association may be obtained free of charge from the Association, 70 East 45th Street, New York 17, N.Y. The standards listed represent in each case general agreement on the part of the maker, seller and user groups as to the best current industrial practice. A new price list makes available a complete set of all American Standards at $225, and a complete set of all American Safety Standards at $35. Quantity discounts range from 20 to 40 percent.

Waterways Experiment Station. Information on the organization and functions of the Waterways Experiment Station has been made available by the Army Corps of Engineers in a recent 23-page illustrated pamphlet, entitled *The Waterways Experiment Station*. Inquiries should be addressed to the Station at Vicksburg, Miss.

Ports and Terminals. Publication of the 1948 edition of Miscellaneous Series No. 4, *Port and Terminal Charges at United States Great Lakes Ports*, has been announced by the Army Board of Engineers for Rivers and Harbors. Copies may be obtained for 35 cents each from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Apprentice Training. A study of practices in 39 apprenticeship programs established in a variety of trades in the construction industry is the basis of a new Department of Labor booklet, *Apprenticeship Credit for Previous Experience*. Copies of this booklet, which is written to answer inquiries growing out of the return of veterans to apprenticeship, may be obtained free of charge from the Bureau of Apprenticeship, U.S. Department of Labor, Washington 25, D.C.

Maps. As part of its newly reorganized Catalog of Copyright Entries, the Copyright office of the Library of Congress is issuing a series of map catalogs. The first issue of the catalog, covering the period January–June 1947, is now on sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at $1.

Port of New Orleans. Technical and physical aspects of operation and administration of the Port of New Orleans are covered in a recent revision, made jointly by the Army Board of Engineers for Rivers and Harbors and the United States Maritime Commission. Issued as No. 20 of the Port Series, the report may be obtained at a cost of $1.50 upon application to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Materials Handling. Proceedings of the Conference on Materials Handling, held in Cleveland in January 1948, have been made available in book form. Copies of the 84-page volume may be purchased from Clapp and Poliak, 350 Fifth Avenue, New York, at $1 each.

Engineering Research. To facilitate engineering research, the Southeastern Research Institute, Inc., has developed a new reference guide for the profession. This publication, entitled *Directory of Engineering Data*, is priced at $2.50. Inquiries should be addressed to the Institute, 5009 Peachtree Road, Atlanta, Ga.

Airports. Proceedings of the Fifth Aviation Conference and Second Airport Management Conference, held at the Agricultural and Mechanical College of Texas in the fall of 1947, have been made available as Bulletin No. 104 of the Texas Engineering Experiment Station. The 214-page publication, which covers numerous aspects of airport management and planning, may be obtained from the Texas Engineering Experiment Station, A. and M. College of Texas, College Station, Tex.

Water Resources. Local floods in Ohio during 1947 are reported in Bulletin No. 14 of the Ohio Water Resources Board. The 66-page manual, written by Walter P. Cross, Assoc. M. ASCE, continues the survey of groundwater resources of the state being made by the Ohio Water Resources Board in cooperation with the Water Resources Branch of the U.S. Geological Survey. Inquiries should be addressed to the Ohio Water Resources Board at Columbus, Ohio.

Housing. A factual analysis of the housing situation, made by the Congressional Joint Committee on Housing to aid the 80th Congress in formulating a national housing policy and program, has been made available as House Document No. 629. This 180-page report, entitled *Housing in America*, may be obtained from the Government Printing Office, Washington, D.C.

Street Design. The American Road Builders Association has made available in reprint form a paper, "Modern Street Intersection Design, Washington, D.C.," by S. R. Harrison, which was presented at the 44th annual convention of the ARBA. Issued as Bulletin No. 131, the reprint may be obtained from the ARBA, 1319 F Street, Washington 4, D.C.

Civil Engineering Booklist. To provide a ready reference work for young civil engineers, especially those in the teaching field, the Civil Engineering Division of the American Society for Engineering Education has compiled a *Selected Booklet for Civil Engineers*. The present list brings up to date a similar check list issued by the ASEE in 1939. It may be obtained free of charge from Society Headquarters, 33 West 39th St., New York 18, N.Y., or from the secretary of the ASEE, Northwestern University, Evanston, Ill.

Refresher Courses. A revision of *Refresher Notes on Hydraulics, Thermodynamics, and Machine Design*, used in refresher courses in preparation for professional engineering license examinations, has been issued by the author, John D. Constance. The volume, consisting of 174 hand-lettered pages reproduced by photo-offset, may be obtained from the author, 506 Olympia Avenue, Cliffside Park 7, N.J. The price is $4.50.

Fire protection. Essential information on standard practice in the field of fire prevention and protection has been assembled in a *Handbook of Fire Protection*, issued in revised form by the National Fire Protection Association. Copies of this 1,500-page publication may be obtained from the Association, 60 Batterymarch Street, Boston 10, Mass., at $9.50 each.

NEWS OF Engineers

W. P. Wiltsee has retired as chief engineer of the Norfolk & Western Railway Co. Mr. Wiltsee was with the railroad for 47 years, having gone into its service when the old Cincinnati, Portsmouth and Virginia Railroad by which he was then employed, was purchased by the Norfolk & Western.

Ronald Greene, Asheville, N.C., architect, has opened an office in Kingsport, Tenn., as senior member of the firm of Greene and Robelot. He will divide his time between the Asheville and Kingsport offices.

Hunter Rouse, director of the Iowa Institute of Hydraulic Research and professor of fluid mechanics at the University of Iowa, has been awarded the $1,000 George Westinghouse Award of the American Society for Engineering Education, presented anually "for distinguished contributions to the teaching of engineering students." Professor Rouse was cited in the award "for his extensive influence upon the teaching of fluid mechanics, for his revealing synthesis of diverse information, and for his inspiring guidance to students and associates." Professor of fluid mechanics at Iowa since 1939, Dr. Rouse has been director of the Iowa Institute of Hydraulic Research since 1944. Before going to Iowa he held positions at California Institute of Technology, Columbia University, and the Massachusetts Institute of Technology. In 1938 he was awarded the Norman Medal by ASCE "for an original paper considered an especially distinguished contribution to the engineering profession."

Hunter Rouse

John M. Fitzgerald is new chief engineer of the New York City Board of Water Supply, succeeding **Roger W. Armstrong** who retired recently to become chairman of the board of consultants (June issue, page 84). Mr. Fitzgerald began his career with the Board of Water Supply in April 1906, and had been deputy chief engineer since early in 1945.

Frederick T. Paul is retiring as city engineer of Minneapolis, Minn., after 40 years of service. He has been with the city engineer's department ever since his graduation from the University of Minnesota in 1909.

Emmett H. Hensing, for the past two years pavement engineer with Buell and Winters, Sioux City, Iowa, engineering firm, has resigned to take a civil service appointment with the Corps of Engineers at Omaha, Nebr., as materials engineer for the Missouri Valley development. Mr. Hensing was with the TVA for three years.

Joseph Latimore recently was appointed city engineer of Coeur d' Alene, Idaho. He was formerly state sanitary engineer.

Ralph W. Stewart has retired from his position as engineer in charge of bridge and structural design in Los Angeles. Mr. Stewart was with the board of public works in that city for 38 years.

Theodore M. Kuss recently established a general civil engineering practice in San Francisco. He was formerly chief engineer with the Pacific Bridge Co.

Burwell Bantz has resigned as city engineer of Tacoma, Wash., but will serve as consulting engineer for the city for a short time. He was Washington state highway director for four years before becoming city engineer three years ago.

Clyde Needham, city planning engineer of Knoxville, Tenn., for the past year, is now with the Rust Engineering Co. at Birmingham, Ala.

Francis E. Twiss, former assistant professor in the Bureau of Highway Traffic at Yale University, has joined the staff of the Chamber of Commerce of the United States. He will be in the transportation and communication department, working with **Col. Alvin B. Barber** and **Harold F. Hammond** as a highway transportation specialist.

Frank G. White, chief engineer for the Board of State Harbor Commissioners, Port of San Francisco, has retired after 37 years of service. He has been chief engineer for the past 21 years.

Harold W. Streeter is retiring as officer in charge of the Federal Security Agency's Water and Sanitation Investigations Station in Cincinnati, Ohio, after 34 years with the Public Health Service. Mr. Streeter joined the PHS in 1914, working on the first Ohio River study for two years. In 1921 he organized the Joliet laboratory on the Illinois River and directed it until its completion in 1923 when he went to Cincinnati.

Walter P. Warendorff, chief architect-engineer for the Veterans Administration in New York State, Puerto Rico, and the Virgin Islands, has been elected president of the Rensselaer Alumni Association's New York Chapter.

W. T. Eiffert has resigned as district engineer for the Washington State Health Department, Spokane, to become engineer on sanitary and water supply work with the Ralph Woolpert Co., consulting engineers of Dayton, Ohio.

David B. Lee recently was elected chairman of the Conference of State Sanitary Engineers at their annual meeting in Washington, D.C. Mr. Lee is chief sanitary engineer, Florida State Board of Health, Jacksonville.

Mark D. Hollis has been appointed chief of the Sanitary Engineering Division of the U.S. Public Health Service. In his new post, he will direct all the sanitary engineering activities of the Service. Previously Mr. Hollis was director of the Service's communicable disease center, and he had served as executive officer in the office of the Surgeon General and been in charge of the Service's malaria control program in war areas.

William D. Wrightson, construction engineer of Chevy Chase, Md., has been appointed engineering assistant in the Office of Civil Defense Planning, which is attempting to establish a permanent civil defense agency. Mr. Wrightson worked on construction of the Panama Canal from 1910 to 1912 and has had experience in sanitary engineering for the Public Health Service, and as consulting engineer for the Peruvian government. In World War I he served as a colonel and chief of the Sanitary Corps of the Army. He is president of the Panama Canal Society.

W. D. Wrightson

Roy E. Jorgensen is now a deputy commissioner of the Connecticut State Highway Department. He was formerly director of highway planning studies for the department.

Arthur Ellwood has been named project manager to direct the survey and preparation of a report on the Delaware River Port for the Delaware River Joint Commission of Pennsylvania and New Jersey. Mr. Ellwood, associated with the Knappen Tippetts Abbet Engineering Co., New York, recently returned from Greece where he was in charge of the firm's work on design in connection with the rehabilitation of the Greek ports and the Corinth Canal. **Edward K. Bryant** has been named director of the Knappen firm's newly opened Philadelphia branch.

John C. King, former senior engineer for the International Engineering Co., Inc., Denver, Colo., is now chief engineer for the Prepakt Concrete Co., Cleveland.

Chester A. Hogentogler has retired as chairman of the Highway Research Board's Department of Soils Investigations. He has been succeeded by **Harold Allen,** senior materials engineer of the U.S. Public Roads Administration. Mr. Hogentogler also is retiring from his position as principal highway engineer of the PRA.

Robert H. Dodds is now associate editor of *Engineering News-Record,* with headquarters in New York. Mr. Dodds was previously associate professor of civil engineering at Colorado A. & M. College, and from 1937 to 1940 he was on the editorial staff of *Engineering News-Record.* He served in the Civil Engineer Corps of the Navy during World War II, attaining the rank of lieutenant commander.

Neal Bryant Garver, of Little Rock, Ark., received the honorary degree of doctor of laws from the University of Arkansas at its 74th annual spring commencement, June 5. Mr. Garver, bridge engineer for the Arkansas State Highway Department, has been with the department for 29 years. He is a past-president of the Mid-South Section of the Society.

William E. Schubert, vice-president and manager of the Wisconsin-Michigan Power Co., Appleton, Wis., has been elected president of the Wisconsin Utilities Association.

VITRIFIED CLAY PIPE
HELPS SET NEW HOSPITAL STANDARDS

THE $770,000,000 hospital program being undertaken by the Corps of Engineers for the Veterans Administration is reaching new heights in hospital standards. These new standards are recognizable mainly in the vast array of facilities for both medical and psychiatric treatment . . . in the use of all of the known science and arts for returning a high percentage of the disabled to useful and self-respecting living.

These new standards are also reflected in modern designed-for-tomorrow buildings. Into these architectural masterpieces are going the world's finest construction materials.

Engineers on these projects recognize the vital importance of top-quality workmanship and materials *below* ground as well as above. That's why there is so much insistence on Vitrified Clay Pipe for sewerage and drainage lines. For Vitrified Clay Pipe is the only pipe impervious to the action of acids . . . chemicals . . . alkalies . . . rust . . . corrosion . . . disintegration.

This high resistance factor of Vitrified Clay Pipe gets a special vote of confidence from hospital designers. The pipe they specify *must* handle safely the acid and chemical wastes of hospital laboratories and facilities!

More than a mile and a half of Vitrified Clay Pipe is being used for the exterior sanitary and storm sewers of the 475-bed Veterans Administration Hospital being constructed at Wilkes-Barre, Pennsylvania. KELLY & GRUZEN, New York City architectural-engineering firm, is in charge of the project.

Conduct your own "Gallup Poll." Ask your friends — any men in the field — if they have ever heard of *a single instance where Vitrified Clay Pipe has ever worn out!* Their answers will speak for themselves.

IF you need specific information on a Clay Pipe problem, write the details to the office nearest you.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

100 North La Salle Street, Room 2100, Chicago 2, Ill.
522 First National Bank Bldg., Atlanta 3, Ga.
703 Ninth and Hill Bldg., Los Angeles 15, Calif.
1105 Huntington Bank Bldg., Columbus 15, O.

C-148-2

Vitrified
CLAY PIPE

ASCE President Richard E. Dougherty, vice-president of the New York Central, and **Philip Sporn** and **D. B. Steinman,** New York City consultants, all graduates of Columbia University, were awarded medals by their alma mater at commencement exercises on June 3. Mr. Dougherty and Mr. Sporn received University Medals and Mr. Steinman the Columbia University Medal for Excellence. The citation accompanying Mr. Dougherty's medal read: "An engineer whose sound abilities and executive vision have for many years maintained the flow of transportation along one of the great arteries that bring commerce and prosperity to this city." Mr. Sporn's citation commended his "alertness to current trends, and extraordinary and much-respected appraisals of power development," while Mr. Steinman's cited his standard "always to place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations."

Merit Penniman White has been appointed professor of civil engineering at the University of Massachusetts. He was previously engineering consultant to the War Department.

A. J. Dyer, chairman of the board of the Nashville Bridge Co., and founder of the company in 1902, was honored recently by the more than 700 employees of the organization on the occasion of his 80th birthday.

Col. D. A. Morris, Army Corps of Engineers, has assumed new duties as district engineer of the Duluth District. He was until recently executive officer, Great Lakes Division, Corps of Engineers, Chicago. Colonel Morris has been in the Corps of Engineers since 1921, and has served in Panama, the Philippines, at the Rock Island, Ill., District, and as engineer in charge of the Engineer ROTC unit at Oklahoma A. & M. College. In 1941 he took a battalion of the 21st Engineer Regiment to Iceland, where he was in charge of all Air Force construction. He commanded the First Airborne Aviation Engineer Training Center at Westover Field, Mass., in 1942–1943, the Task Force for Air Force operations and developments at Lagens, Azores Islands, during the first half of 1944, and the assualt forces on Iwo Jima.

Col. D. A. Morris

Carl C. H. Tommerup has opened a consulting office in Seattle, Wash. He formerly was senior structural engineer with the Pacific Islands Engineers in the Marianas Islands, with headquarters at Guam.

L. Sterling Hedgpeth, senior highway engineer with the Public Roads Administration, is now in Turkey assisting in laying out a modern highway network under the Turkish Aid bill. For the past four years, Mr. Hedgpeth has been employed in the department of design in the PRA Washington office.

Walter D. Binger, vice-president of the City Investing Co., New York, has been appointed a consultant to the Technical Division, Office of Civil Defense Planning. During World War II Mr. Binger served on the National Technological Advisory Committee and the National Committee on Civilian Protection. He is a graduate of Massachusetts Institute of Technology. The Officeof Civil Defense Planning is being organized to develop plans for the civil defense of the country and to promote a program of legislation needed to establish a permanent peacetime agency.

Walter D. Binger

Franklin O. Rose is now professor of civil engineering at the University of Puerto Rico in Mayaguez. Until recently he was associate professor of civil engineering at Brown University. While at Brown he was Faculty Adviser to the ASCE Student Chapter.

John S. Cotton has established a consulting engineering office at San Anselmo, Marin County, Calif. He recently returned from China where for the past three years he was chief engineer of the National Hydroelectric Engineering Bureau and adviser to the Supreme Economic Council on Yellow River problems.

Fred S. Childs is the newly elected president of the New Jersey State Board of Professional Engineers and Land Surveyors. Mr. Childs, whose home is in Clifton, N.J., has a consulting practice in New York City.

Charles A. Maguire, Providence, R.I., consulting engineer, was awarded an honorary degree of doctor of science at the 102nd commencement exercises of the College of the Holy Cross, Worcester, Mass. Mr. Maguire, head of the engineering group which recently compiled the traffic report of Metropolitan Boston and the expressway system report for Metropolitan Providence, attended Holy Cross and received an honorary degree of master of science from the institution in 1934.

Frank W. Edwards is the newly appointed director of the department of civil engineering at the Illinois Institute of Technology, Chicago. For the past two years he has been professor of civil engineering at the Carnegie Institute of Technology.

William N. Brown, Washington, D.C., president of the W. N. Brown, Inc., recently retired from active survey work, but will continue to serve his firm in a consulting capacity. For many years chairman of the executive committee of the Surveying and Mapping Division of the Society, Mr. Brown during his 47 years of private practice has made surveys in Alaska, Bermuda, Mexico, and in many parts of this country.

Edward E. Stickney has been promoted from the position of associate district engineer of the New York State Department of Works at Binghamton to that of assistant engineer in the Albany district.

Dewitt L. Pyburn has been appointed member of the Mississippi River Commission, Vicksburg, Miss., succeeding the late **H. N. Pharr.** Mr. Pyburn formerly was director of public works in Louisiana.

Norman D. Kenney, formerly senior associate engineer for the Baltimore firm of Whitman, Requardt & Associates, has joined the staff of G. Douglas Andrew Associates, engineering consultants of Towson, Md.

Lt. Gen. Eugene Reybold, former chief of the U.S. Army Corps of Engineers, now retired, recently was named vice-president in charge of operations of the Lustron Corp., manufacturers of porcelain enamel, all-steel homes.

William G. Buecheler has opened a consulting office in Jacksonville, Fla. He was with Reynolds, Smith and Hills in that city prior to establishing his own practice.

Dr. Harold Vagtborg, president and director of Midwest Research Institute at Kansas City, Mo., since its inception in January 1944, resigned recently to become president and director of Southwest Research Institute at Houston, Tex. His new position will include duties as director of both the Institute of Inventive Research and the Foundation of Applied Research, and as technical director of the 3,500-acre Essar Ranch, also located near San Antonio.

Wilson V. Binger has gone to Buenos Aires for the engineering firm of Parsons, Brinckerhoff, Hogan & Macdonald. Until recently he was chief of the soils and geology branch of the Missouri River Division of the Corps of Engineers at Omaha, Nebr.

Col. J. Lester White is newly appointed director of the Louisiana State Department of Public Works. For the past year he has been with the Ethyl Corp. at Baton Rouge following six years in the Army. Colonel White was at one time head of the Louisiana State Planning Commission.

Deceased

Edward Webster Crellin (M. '09) died at Pasadena, Calif., on May 16. His age was 85. A retired steel executive and civil engineer, Mr. Crellin founded the Des Moines Bridge & Iron Works and was a former president of the Amalgamated Pittsburgh-Des Moines Steel Co. He worked as a draftsman for the Department of Surveys and Grades for the 1893 World's Columbian Exposition in Chicago and later worked on the structural steel roof of the Congressional Library in Washington, D.C.

William Garrett Grove (M. '17) died on May 27 at Grand Rapids, Mich. He was 66. His entire career was spent in the field of bridge design and he had been since 1924 with the Connecticut State Highway Department, first as a special consultant and since 1938 as engineer of bridges and structures. He worked on many bridges in the New England states, in New York State and on the sky ride and observation towers at the Chicago Century of Progress Exposi-

Wickwire Rope is "Tissue Tested"

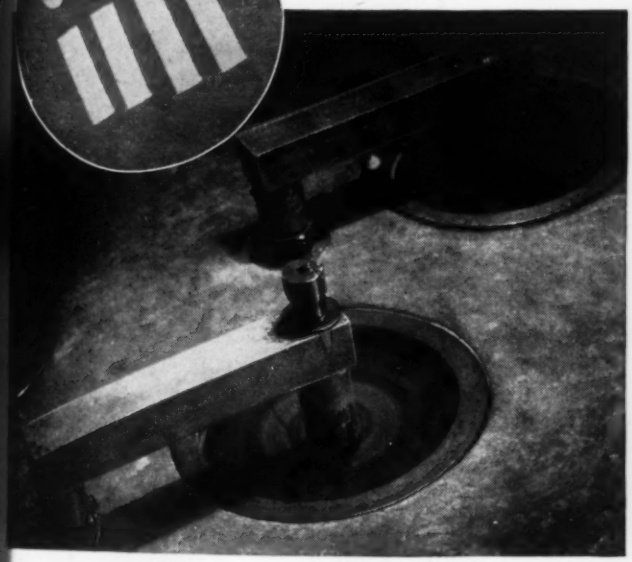
With the same scientific care a physician uses in examining human tissue, technicians in the Physical Testing Laboratory of Wickwire Spencer's Rope Mill test samples of wire imbedded in plastic "buttons." Samples from coils of wire are ground, polished, etched, microscopically examined and the findings recorded.

What's this got to do with wire rope? The grain size has an important bearing on the life span of the wire. Because the quality of the steel in the rope wire is just as important for dependable service as is the construction of the rope, Wickwire uses only such wire as passes the Physical Testing Laboratory's exacting standards.

For the utmost in performance, safety and long life, specify Wickwire Rope. It is available in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed. Call on Wickwire distributors and Wire Rope engineers to help solve your wire rope problems and supply the right rope for your needs.

HOW TO PROLONG ROPE LIFE AND LESSEN ROPE COSTS

Thousands of wire rope users have found that the information packed in the pages of "Know Your Ropes" has made work easier and rope last longer. It's full of suggestions on proper selection, application and usage of wire rope. It's easy-to-read and profusely illustrated. For your free copy, write, Wire Rope Sales Office, Wickwire Spencer Steel, Palmer, Massachusetts.



WICKWIRE ROPE

A PRODUCT OF THE WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

CF&I & SUBSIDIARIES

WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass. **EXECUTIVE OFFICE**—500 Fifth Avenue, New York 18, N. Y.

SALES OFFICES—Abilene (Tex.) • Boston • Buffalo • Chattanooga • Chicago • Denver • Detroit • Emlenton (Pa.) • Philadelphia • Tulsa • Fort Worth • Houston • New York

PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

tion in 1933. He also designed the Middletown, Conn., bridge which received first prize from the American Institute of Steel Construction as the most artistic steel bridge costing more than $1,000,000 built during 1938.

Elwood Norman Layfield (M. '07) died on May 22 at his home in Sierra Madre, Calif., at the age of 76. He retired in 1933 after several years as engineer of construction for the Hope Engineering Co. at Mount Vernon, Ohio. He was at one time in charge of building new piers for bridges over the Patapsco and Patuxent rivers between Baltimore and Washington. Early in 1899 Mr. Layfield went to Chicago to work as assistant engineer for the Chicago Terminal Transfer Railroad Co. He became chief engineer of the road in 1905.

James Vallence Nimmo (M. '12) died on March 30 at his home in Leeds, England. His age was 72. He was senior adviser, payment by results, for the British Ministry of Works. Mr. Nimmo did railroad, bridge, dock and harbor construction work in England, Scotland, India and Canada. While employed by the public works contracting firm of S. Pearson & Son, Ltd., he designed the shields for the East River tunnels in New York. Later he was chief engineer for the location and construction of the Atlantic Quebec & Western Railway in Quebec, and for five years prior to the first World War was division engineer on Western Canada railroad projects through the Rocky Mountains.

Horace Hamilton Person (Assoc. M. '20) died on May 17, 1947, although word of his death has just reached the society. His age was 53. Mr. Person was with the Army Corps of Engineers at Portland, Ore., at the time of his death. He was superintendent of construction with the Ann Arbor Construction Co. (Mich.) from 1921 to 1925 when he established his own contracting firm. Four years later Mr. Person became superintendent of construction and management for the Peninsula Paving Co. and California Construction Co. at San Francisco. In 1933 he became a life underwriter for the Penn. Mutal Life Insurance Co.

Thomas Dickinson Searl (M. '38) who retired a year ago as chief engineer of the George A. Fuller Construction Co., New York, after 45 years of service with the firm, died on May 10 at his home in New Dorp, Staten Island, N.Y. His age was 69. Mr. Searl, who began his career with the New York company following his graduation from Cooper Union, was a consultant for the firm during the past year.

Los Angeles Hyperion Project Ends Beach Contamination

(*Continued from page 23*)

with the financing problem for many months without coming to a conclusion, one stumbling block being the uncertainty as to whether outside cities and areas would contribute their share of the project cost.

Threatened with court action and a fine of $1,000 a day, the City Council placed a 10-million-dollar general bond issue before the voters at the April 1945 election. Every newspaper and civic organization was behind the proposition, which was carried 7 to 1. Court action had a similar effect on the outside cities, which proceeded almost at once to arrange to meet their share of the costs.

Fortunately the California State Legislature in February 1946 enacted a bill granting certain sums to California cities for postwar work on a fifty-fifty basis. Los Angeles and the other contracting cities will share this grant to an extent that will assist in the financing of the project.

The total estimated cost of the plant and the new submarine outfall, because of rising costs, has advanced to 41 million dollars. The sewage flow from the outside cities and areas amounts to nearly 24 percent of the total, and these communities will pay their share of the project cost on the basis of the percentage of sewage each discharges into the system.

The firm of Metcalf & Eddy, Boston, Mass., has been retained to review all plans for the treatment plant being prepared by the Los Angeles Bureau of Engineering.

Engineering Principles in the Design of Houses

(*Continued from page 17*)

the National Bureau of Standards.[1] Because the Bureau program is a pioneering attempt to apply engineering principles in the design of houses, further studies will no doubt be needed before universally acceptable methods are developed.

An engineering approach to the strength of houses will open the way for designers to introduce unconventional materials and unusual methods of fabrication through laboratory tests to determine whether the designs possess adequate strength. Such data will greatly shorten the time required to develop and obtain acceptance of new types of construction for houses. At the same time, a substantial saving of materials as well as improved protection against storm damage should result.

[1] BMS 109, Strength of Houses. Application of Engineering Principles to Structural Design, Herbert L. Whittemore, John B. Cotter, Ambrose H. Stang, and Vincent B. Phelan. BMS 109 can be obtained only from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. The price is $1.50 a copy.

Bureau of Reclamation Procedures Control Program

(*Continued from page 35*)

larly shown, such as supporting contracts, rights-of-way, force account and engineering and administration —items which, added to the major contracts, go to make up the total cost of a project.

The detailed analyses of project features were of great interest to Congressional appropriation committees and were studied closely by the committee members. A few of the schedules were published in the record of the hearings. Because of their interest, the analyses, which are now known as "schedules of contract earnings and other costs," have been made a standard requirement supporting the Bureau's presentation to Congress and are being adopted on most Bureau projects as a "work sheet" of information supporting the annual program schedule.

Preparation of data and estimates in this manner has proved very satisfactory, and has greatly facilitated the presentation of information to the Bureau of the Budget and to Congress, permitting omission of the voluminous details which Congressional committees previously required.

At the beginning of the 1948 fiscal year, that is, on July 1, 1947, construction was proceeding at an unprecedentedly high rate, owing to the lifting of wartime restrictions and the general improvement in labor and supply conditions, coupled in some localities with unusually favorable weather. As a result, the regular appropriations for the fiscal year 1948 had to be supplemented in order to continue construction throughout the entire fiscal year. This temporary inadequacy of funds pointed up the fact that, although the Bureau's contracts provided for such contingencies, the rights and obligations of the contracting parties in such cases were not clearly spelled out in the contracts.

Form of Contract Revised

After lengthy discussion before the Appropriations Committees of Congress, the Bureau has revised its form of contract so that each contractor is fully informed as to the amount that will be available for payment under his contract for the fiscal year for which the appropriations are made, and as to the procedures that will be followed in the event of an exhaustion of funds. Similar information as to the status of funds will be given to contractors holding contracts pre-

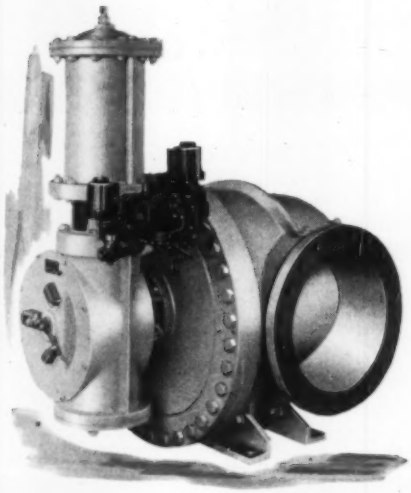
Dangerous Days -

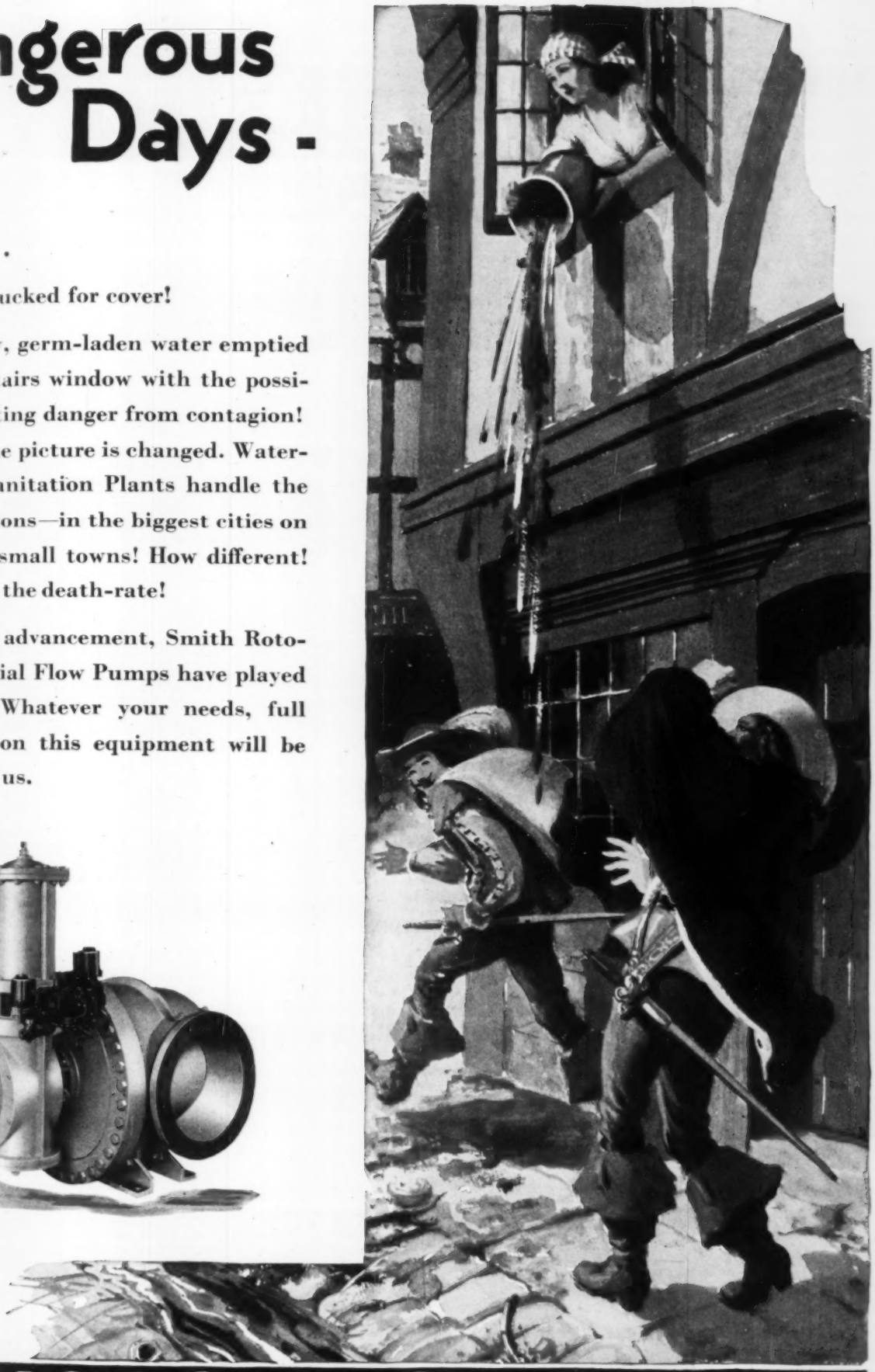
SPLASH! . . .

And people ducked for cover!

A jar of filthy, germ-laden water emptied from an upstairs window with the possibility of creating danger from contagion! But today, the picture is changed. Waterworks and Sanitation Plants handle the needs of millions—in the biggest cities on down to the small towns! How different! What a cut in the death-rate!

In this great advancement, Smith Rotovalves and Axial Flow Pumps have played their parts. Whatever your needs, full information on this equipment will be useful. Write us.





S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

viously made, which do not contain the revised provisions.

The monies allotted to each contract will be reserved for that contract, and will be entered on the Bureau's accounts as an obligation. Such reservations of funds appear on the detailed construction analyses, with which the annual program and control schedules are reconciled. No revision of these reservations is made in any one fiscal year unless it is definitely determined that the funds are in excess of the amount that will be required in that year to meet the contractor's earnings, including the percentages retained in accordance with the contract, to be paid on completion and acceptance of the work. If there is actually a surplus during any one year, the excess may be applied toward other authorized work or activity.

Bureau Plans Continued Use of Schedules

Reporting against the project control and annual program schedules is accomplished by four forms. One form reports on the progress of the work by project features; this form reports in dollars against the annual approved program, the cost for each month as the year goes by and any changes in estimates of work that must be pushed over into the next fiscal year. A supporting form gives the breakdown analysis of every contract with a face value of over $10,000, whether for construction, supply, or equipment, showing the cost to date and the balance required to complete the contract for the fiscal year. These two reports are the combined products of engineers and accountants. A third report shows the status of the appropriation and is made to the Treasury Department to provide essential finance data, and to the Bureau of the Budget as a check against its quarterly apportionment.

A system of reporting on "flagged actions" taken from the annual schedules has been developed and put in effect. Each month the field offices report on the flags listed for action for that particular month, as to whether the work is up to date, is ahead, or is behind schedule. These actions are summarized by the Commissioner's office in terms of percentages of accomplishment, and are used as an indication of the progress of the Bureau's work. When the system was initiated the percentage of accomplishment was low—less than 50 percent—not only because of optimism in setting the date for actions but also because of unfamiliarity with the new procedure, and the need for a training period to familiarize new people with the Bureau's problems and methods of solution.

At the present time the procedures and reports described herein are in effect and are accomplishing their purpose in controlling the Bureau's programs. Engineers and accountants are cooperating fully. The Bureau of Reclamation is modernizing its accounting systems and field procedures to provide rapidly and accurately the necessary information for these schedules and reports. The Bureau intends to develop the best possible procedures and the most modern methods so that the desires of Congress and the taxpayers may be met in the accounts and records of the Bureau.

Los Alamos—The Town the Atom Is Building

(*Continued from page 39*)

Directed Operations, United States Atomic Energy Commission." Among his assistants are several members of ASCE, one of his principal assistants being Theodore B. Jenson, Assoc. M. ASCE, formerly of Minneapolis, Minn. Mr. Jenson is "Director of Operations," which covers all general construction and all maintenance and municipal engineering on the project. Elmo R. Morgan, Jun. ASCE, formerly of Salt Lake City, is another, with the title of "Assistant and AEC Manager." With one of the architect-engineer firms on the project is a former editor of CIVIL ENGINEERING, Don Johnstone, Assoc. M. ASCE.

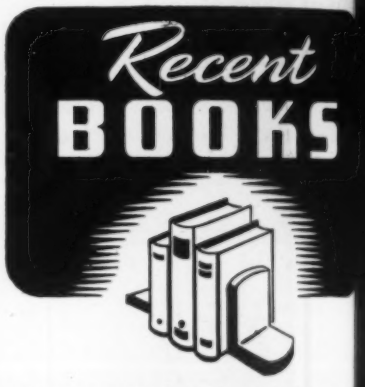
Many of the signs of the former military direction of the project and the town already are gone. Except for its odd-looking factories, and its exceptionally energetic, purposeful citizens, Los Alamos, in appearance, might be any model town of 9,000 on some beautiful and peaceful mountain plateau. In reality, there is no other town in the world just like it. Probably in no other place is the mysterious present and future of fissionable material so much the interest and the business of so many competent men. Los Alamos is a town of the future, today.

New Construction Activities Compared on 1939 Price Basis

(*Continued from page 29*)

cial Feature" containing information on the following subjects: Voluntary agreements program for construction and housing, trends of selected types of construction activities and materials, recent st construction estimates, exports selected construction materials, co struction data for March 1948, a recent figures on the production construction materials.

According to the Department Commerce reports, all new constru tion activity in the first four mont of 1948 amounted to $4,601 millio 32 percent above the correspondi period for 1947. Private constru tion totaling $3,716 million cons tuted four-fifths of the total and w 35 percent above the dollar volu put in place during the first fo months of 1947. New public co struction totaled $885 million dur the first four months of 1948, 22 pe cent above the figure for the cor sponding period of 1947. Private financed residential construction p in place in the first quarter of 19 measured in 1939 prices, was 39 pe cent higher than in the correspondi period of 1947.



ALUMINUM AND ITS ALLOYS. By N. F. Budgen ed. Sir Isaac Pitman & Sons, Ltd., London, 19 369 pp., illus., diagrs., charts, tables, 8¼ X 5 in., cloth, 25*s*. This book provides an outline the various branches of metallurgical work lated to and comprising the aluminum indus It describes the properties, processes and me ods employed in the manufacture of alumin and its alloys, and their applications to mode engineering. This edition has been revised a brought up to date to include the latest develo ments in this branch of metallurgy.

AMERICAN PLANNING AND CIVIC ANNUAL. Edi by Harlean James. American Planning a Civic Association, Washington (D.C.) 19 212 pp., illus., 9¼×6 in., cloth, $3 (or includ with *Planning and Civic Comment*, issued quar terly, in annual $5 memberships of the Asso tion or the National Conference on State Park Containing texts prepared by leaders in conser tion and planning fields, the book is a record recent civic advance in the fields of planni parks, housing, neighborhood improvement a conservation of natural resources. It also in cludes addresses and round-table discussions pr sented at the Citizens' Conference on Planning Milwaukee, Wis., together with papers read at National Park Conference in Washington duri the past year.

CONCRETE WATERPROOFING. By L. E. Hunt Sir Isaac Pitman & Sons, Ltd., London, 19 127 pp., illus., diagrs., charts, tables, 8½X5 in., cloth, 12*s*.6*d*. General waterproofing pr ciples and methods are given, together with short outline of the nature and composition of individual types of waterproofers. Specifica tions and test methods are included, and o chapter is devoted to repairs and joints in wate bearing structures.

CORROSION HANDBOOK. Edited by H. H. Uhl and sponsored by the Electrochemical Soci Inc., New York, N.Y. John Wiley & Sons, 1

Line-up for a solid foundation

...with MONOTUBE tapered steel piles

MANY 1949 construction projects are being lined-up now for a good, solid *start* . . . with Monotube foundations.

Include Monotube tapered steel piles in your plans for future projects—buildings, piers, bridges, airports, highways. You'll be *starting* right—*saving* in advance. Gauges, sizes and tapers to meet varying soil conditions.

Monotubes have been favorites for years with cost-conscious engineers and builders because . . .

Monotubes' fluted, tapered design speeds driving;
They are easily extendible, right on the job;
Their sturdy construction eliminates use of driving mandrel;
Light in weight, they are easily and quickly handled;
Monotubes' tubular construction makes inspection, before concreting, quick and easy.

For complete information, write The Union Metal Manufacturing Company, Canton 5, Ohio.

You are cordially invited to visit our exhibit at the ROAD SHOW Soldier Field, Chicago July 16 to 24 BOOTH 1007

We regret the present extended delivery schedules due to the steel shortage, but you will find Monotube Piles well worth waiting for.

UNION METAL

Monotube Foundation Piles

York; Chapman & Hall, London, 1948. 1,188 pp., illus., diagrs., charts, tables, 9¼×6 in., cloth, $12. This reference work provides a condensed summary of information on all phases of corrosion, including a cross section of scientific data and industrial experience. The major emphasis is on corrosion prevention and the behavior of metals and alloys in various environments at both ordinary and extreme temperatures. Quantitative rather than qualitative data are considered. Current corrosion theory is covered as well as corrosion testing. More than 100 authorities in the field contributed, and a wealth of footnote references lead to further treatments of the subject matter.

EXAMINATION OF FRAGMENTAL ROCKS. By F. G. Tickell, rev. ed. Stanford University Press, Stanford, Calif., 1947. 154 pp., illus., diagrs., charts, tables, 10¼ × 7 in., cloth, $4. This book is an outline of the physical properties of fragmental aggregates and of their mineral constituents. It serves as a laboratory manual or guide for all those interested in a practical treatment either of identity or of size and shape relationships of fragmental rocks. A discussion of "degree of rounding" and a description of an improved apparatus for sedimentation analysis have been added to this edition, and neeessary corrections have been made in the older text material.

FUNDAMENTALS OF SOIL MECHANICS. By D. W. Taylor. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1948. 700 pp., illus., diagrs., charts, tables, 8¾ × 5½ in., cloth, $6. Written for use in graduate courses, this text supplies fundamental theory rather than answers to practical problems. Simple soil tests, subsurface investigations, settlement analysis, seepage, stability of slopes, and the action of shallow foundations are among the topics considered. Problems are included as well as a bibliography of source material.

HANDBOOK OF STRUCTURAL DESIGN IN THE ALUMINUM ALLOYS. By J. E. Temple. James Booth & Company Ltd., Birmingham, England, 1947. 147 pp., diagrs., charts, tables, 8¾×5½ in., cloth, 21s. Of interest to engineers who deal with framed structures, this book covers the use of light-weight material in eonstruction. It is divided into two parts. In Part I the most suitable alloys are described with regard to their general properties, characteristics of strength, and general working. Part II covers the more technical aspects of the subject. It is written for engineers already experienced in the design of steel structures. Stress is laid chiefly on those questions in which practice might be expected to differ in the usage of the light alloys and of steel.

MANUAL OF STRUCTURAL DESIGN. By J. Singleton. 3 ed. H. M. Ives & Son, 415 Kansas Ave., Topeka, Kans., 1947. 336 pp., diagrs., charts, tables, 10¼ × 7 in., fabrikoid, $6. Intended for the practicing engineer, this book applies the fundamentals of structural design in the formulation of data that bear directly on specific cases. In order to keep the manual up to date, this third edition contains the latest specifications of the American Institute of Steel Construction and other new material. The included data are presented chiefly in the form of tables or graphs for more effective use.

MODERN TIMBER DESIGN, 2 ed. By H. J. Hansen. John Wiley & Sons, New York; Chapman & Hall, London, 1948. 312 pp., illus., diagrs., charts, tables, 9¼×5¾ in., cloth, $4.50. The properties of various species of wood, the factors affecting their structure, their assigned working stresses, and modern timber design methods are covered with examples and formulas for use in design. Two new chapters appear in this revised edition, presenting the factors affecting the strength of wood, and a fuller explanation of wood-testing methods. Material on the design of all types of joints, of glued laminated members, and of plywood is featured.

LA PHOTOÉLASTICITÉ. By A. Pirard. Dunod, Éditeur, Paris, 1947. 419 pp., illus., diagrs., charts, tables, 9½×6 in., paper, 1550 frs. Following an extended discussion of the theory of elasticity, this text takes up the subject of photoelasticity from both the theoretical and practical points of view. Birefringence and polarisation are discussed, materials and equipment for photoelastic examination are described in detail, and practical applications are demonstrated with examples of photoelastic studies.

PHOTOELASTICITY, Vol. 2. By M. M. Frocht. John Wiley & Sons, New York; Chapman & Hall, London, 1948. 505 pp., illus., diagrs., charts, tables, 9¼×6 in., cloth, $10. This treatise on advanced principles and methods includes the following: Essential elements of the theory of elasticity; a critical examination of the influence of the physical constants on the state of stress in two dimensions; a broad survey of the methods for the determination of the sums of the principal stresses with special emphasis on the numerical solution of Laplace's Equations. It also presents the theory and technique of three-dimensional photoelasticity with applications to stress concentrations.

LA REGOLAZIONE DELLE TURBINE IDRAULICHE. By G. Evangelisti. Nicola Zanichelli Editore, Bologna, Italy, 1947. 274 pp., diagrs., charts, tables, 9¾×7 in., paper, 2,000 lire. This provides a detailed mathematical analysis of governing and regulation of hydraulic turbine stallations under various conditions: head; with admission and discharge pressure; with surge tanks; etc. The chapters present the fundamental governor action and the equations for motion. The influence of propagation ena is also discussed.

SOIL MECHANICS IN ENGINEERING PRACTICE. K. Terzaghi and R. B. Peck. John Wiley Sons, New York; Chapman & Hall, Ltd., don, 1948. 566 pp., illus., diagrs., charts, 9¼×5¾ in., cloth, $5.50. This book combi discussions of both principles and practice in mechanics. It provides the information to a real knowledge and understanding of the ject and offers definite directions by which engineer can judge the extent to which soil chanics can be profitably used on a given The three main sections are as follows: Part deals with the physical properties of the Part B, with the basic theories of earth stability, and settlement; and Part C, with actual practice of earthwork design and tion.

STRENGTH OF MATERIALS. By J. Marin. Macmillan Co., New York, 1948. 464 diagrs., charts, tables, 9½×6 in., cloth, $ Written as a text for a beginning college this book coordinates mechanical under various types of static stress, stresses, and design of simple machine tural members. Arranged in four parts, deals with simple stresses, Part II with stresses, and Part III with statically nate stresses. Special topics are considered Part IV, and an appendix treats centroids moments of inertia of plane areas. Tables physical properties and design stresses for mon engineering materials are included.

SUBSTRUCTURE ANALYSIS AND DESIGN. By Andersen. Irwin-Farnham Publishing Co., cago, 1948. 300 pp., illus., diagrs., tables, 9×6 in., cloth, $4.50. Written in response to quests for a text dealing exclusively with and design of substructures, this book will ful to structural engineers and will meet the of instructors giving courses in conventi methods of structural design. Topics cov include methods for evaluating lateral earth sures; soil bearing power; current practice footing design; piles and pile driving; and dock and breakwater design. Throughout text, emphasis has been placed on applicati the problems of the designing engineer.

APPLICATIONS FOR ADMISSION OR TRANSFER

July 1, 1948 — Number 7

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know applicant personally as well as upon the nature and extent of his fessional experience. Any facts derogatory to the personal character professional reputation of an applicant should be promptly commu cated to the Board. Communications relating to applicants are co sidered strictly confidenti

The Board of Direct will not consider the app cations herein contained fr residents of North Amer until the expiration of days, and from non-resid of North America until expiration of 90 days fr the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

BAKER, THOMAS HIEATT (Age 47) Area Mgr., Atkinson-Drake-Park of New York, on CPFF War Dept. Contract in Athens, Greece.

BIEDERMANN, ADOLPH CELESTIN (Age 54) Civ. Engr., Board of Water Supply, New York, N.Y.

BOOTH, DONALD ALFRED (Jun.) (Age 35) Gen. Mech. Supt., Dravo Corp., Sewickley, Pa.

BRANIGAN, GEORGE FRANCIS (Assoc. M.) (Age 44) Prof. of Mech. Eng., Iowa State Coll., Ames, Iowa.

BROWN, ELLIS ROBERT (Jun.) (Age 35) Director of Eng., Wilder Constr. Co., Ft. Worth, Tex.

BROWN, FRANKLIN STEWART (Assoc. M.) (Age 38) Chf., Special Eng. Div., Panama Canal, Panama Canal Zone.

BROWN, KENT (Age 50) Dist. Engr., and Asst. Engr. of Surveys, Arkansas Highway Dept., Little Rock, Ark.

CLAPP, PRESCOTT JONES (Age 64) Civ. Engr., New York City Board of Water Supply, Kingston, N.Y.

COOK, WALTER KRYWOOD (Age 48) Head Engr., Sverdrup & Parcel, Cons. Engrs., on work U.S. Air Forces, Webster Groves, Mo.

COLGAN, FRANCIS JOSEPH (Age 45) Senior Engr., New York City Board of Water Napanoch, N.Y.

CRANE, ROBERT JOHN (Age 58) Asst. Chf. New York Central R.R. Co., Lines East of falo, New York, N.Y.

DANN, GEORGE HENRY (Age 43) Engr. and Philadelphia Suburban Water Co., Lansdo Pa.

DAVIDSON, HEBERT (Assoc. M.) (Age 46) Engr., Hardesty & Hanover, New York, N.Y.

A "Caterpillar" Diesel No. 12 Motor Grader, owned by Orange County, Calif., grades an access road at Huntington Beach Airport. Price of standard No. 12 Motor Grader is $9925 (without cab or scarifier), F.O.B. Peoria, subject to change without notice.

One-man construction crew

HUNTINGTON BEACH AIRPORT, near Santa Ana, California, ld well serve as a model among smaller airports. Its cellent runways and smooth access roads look as if a fair- d crew were kept busy maintaining them. The fact is t one man and one machine do the work efficiently and nomically!

A "Caterpillar" Diesel No. 12 Motor Grader can do t about any construction job needed around an airport. an grade, drain and lay oil mix on the runways as well build and maintain the roads leading from the field into n. Equipped with a scarifier, as this one is, the No. 12 rip up and renovate old oil mix or smooth out pitted adam.

You don't have to look far for reasons why the terpillar" Diesel Motor Grader has become the stand- unit for highway and airport maintenance. Owners operators like its easy handling and the precision work es. They like its sturdy dependability and long, profit- life. And they appreciate the fact that this is the only or grader built entirely by one manufacturer, with s and service always available through a single well- pped dealer.

TERPILLAR TRACTOR CO., PEORIA, ILLINOIS

CATERPILLAR
REG. U. S. PAT. OFF.

DIESEL

ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

DISARIO, GABRIEL MICHAEL ANTHONY (Assoc. M.) (Age 41) Cons. Engr., Member of firm, Leon, Disario, Hernandez, Caracas, Venezuela.

DOHERTY, CHARLES FRANCIS (Assoc. M.) (Age 43) Asst. Civ. Engr., New York City Board of Water Supply, Neversink, N.Y.

DUGGAN, FRANCIS JOSEPH (Age 46) Asst. Civ. Engr., Watershed Executive Div., New York City Board of Water Supply, Ellenville, N.Y.

EDWARDS, RAY OMER (Age 55) Executive Director, Housing Authority of Jacksonville, Fla.

ENDRESS, STEPHEN GARDNER (Assoc. M.) (Age 40) Engr., Freese & Nichols, Ft. Worth, Tex.

ERSKINE, HARLAN MERCER (Assoc. M.) (Age 39) Dist. Engr., West Virginia Dist., U.S. Geological Survey, Charleston, W.Va.

ESCARIO NUNEZ DEL PINO, JOSE LUIS (Age 52) Prof., Civ. Eng., School of Madrid; Cons. Engr., Madrid, Spain.

FELDMAN, HARRY ROY (Age 37) Civ. Engr. (private practice), Boston, Mass.

FELDT, HAROLD WALTER (Assoc. M.) (Age 36) Engr. P-5 (Specialist), Eng. Div., Corps of Engrs., U.S. Army, Dallas, Tex.

FISHER, JOHN DONALDSON FORD (Assoc. M.) (Age 48) Southeastern Mgr. of Sales, Thew Shovel Co., Lorain, Ohio; Atlanta, Ga.

GENTRY, JAMES ROY (Age 37) Civ. Engr., Stanley Eng. Co., Muscatine, Iowa.

GRENNAN, PHILIP MICHAEL (Assoc. M.) (Age 41) Structural Engr., Ford, Bacon & Davis, Inc., New York, N.Y.

GRUSS, JOHN GODFREY (Assoc. M.) (Age 54) Prin. Engr., Albright & Friel, Inc., Philadelphia, Pa.

HABERSHON, MATTHEW EDMUND (Assoc. M.) (Age 47) Borough Engr. and Surveyor, Walsall Corp., Walsall, England.

HOBBS, EMMETT LEE (Age 38) Member of firm, Smith & Hobbs, Archt.-Engrs., Atlanta, Ga.

HODGKISS, ARTHUR S. (Age 41) Executive Officer, New York City Dept. of Parks, Forest Hills, N.Y.

HOWELL, JOHN TUDHOPE (Assoc. M.) (Age 39) Structural Eng. Consultant, Alaska R.R., Anchorage, Alaska.

IAKISCH, JOHN RUDOLPH (Assoc. M.) (Age 68) Chf., Drainage Sec., U.S. Bureau of Reclamation, Federal Center, Denver, Colo.

JUDSON, FREDERICK (Age 42) Asst. Sec. Engr., New York City Board of Water Supply, Ellenville, N.Y.

KOOKER, DONALD J. (Age 40) Plant Mgr., Rheem Mfg. Co., Chicago, Ill.

KRAMER, DANIEL MACLEAN (Age 46) Engr. (Acting Chf. Engr.), Delaware River Joint Comm., Woodbury, N.J.

KRAUS, ALBERT FRANK (Age 62) Civ. Engr., New York City Board of Water Supply, Downsville, N.Y.

KRING, CHARLES UDELL (Assoc. M.) (Age 37) Cons. Engr., San Francisco, Calif.

LARSON, FRED HERMAN (Assoc. M.) (Age 45) Zone Conservationist (Engr.), SCS, Portland, Ore.

LAWRIE, RITCHIE, JR. (Age 37) Cons. Engr., Member of firm, Lawrie & Green, Harrisburg, Pa.

LEEPER, MARVIN TIDWELL (Age 46) Drawing Room Engr., American Bridge Co., Gary, Ind.

LEON, ERNESTO (Age 49) Cons. Engr., being member of firm, Leon, Disario, Hernandez, Caracas, Venezuela.

MACKLIN, CHARLES GARST (Age 44) Structural Engr. (private practice), Springfield, Ill.

MCGLASHON, DONALD WALKER (Assoc. M.) (Age 46) Civ. Engr., Harland Bartholomew & Associates, St. Louis, Mo.

MAHAPATRA, MRUTYUNJAYA (Age 41) Asst. San. Engr., Gannett, Fleming, Corddry & Carpenter, Inc., Harrisburg, Pa.

MAXTON, HOWARD PRESTON (Assoc. M.) (Age 44) Secy. and Asst. Treas., Raymond Concrete Pile Co., New York, N.Y.

MERGOTT, JOHN GERHN (Age 46) Sec. Engr., New York City Board of Water Supply, Liberty, N.Y.

MERMEL, THADDEUS WALTER (Age 40) Asst. to Commr.-Eng., Bureau of Reclamation, Washington, D.C.; Hyattsville, Md.

MOFFATT, JOHN GRAY (Assoc. M.) (Age 41) Member of firm, Moffatt & Nichol, Inc., Los Angeles, Calif., and Moffatt, Nichol & Taylor, Portland, Ore.; address, Los Angeles, Calif.

MONAHAN, JAMES BRACHER (Age 35) Senior Engr., Ford, Bacon & Davis, Inc., Chicago, Ill.

MOORE, WAYNE STEWART (Age 50) Res. Member, Board of Engrs. for Rivers and Harbors, Dept. of Army, Washington, D.C.

MUSSO, FRANK JAMES (Age 50) Div. Engr., Board of Water Supply, New York, N.Y.

NELSON, ROGER JAMES (Age 39) Civ. Engr., U. S. Forest Service, Missoula, Mont.

NETZER, BENNIE NATHAN (Jun.) (Age 35) Project Engr., U. S. Engr. Office, Pittsburgh, Pa.

NICHOL, FRANK ELLIOTT (Assoc. M.) (Age 47) Member of firm, Moffatt & Nichol, Inc., Engrs., Los Angeles, Calif.

NILES, CHARLES FERNALD (Age 53) Civ. Engr., Grade 3, U.S. Forest Service, Russellville, Ark.

PASSARELLI, EDMUND FRANCIS (Age 39) Chf. of Site Planning, Madigan-Hyland, Long Island City, N.Y.

PIKE, HOWARD GORDON (Age 35) Research Engr., Pittsburgh & Lake Erie R.R., Pittsburgh, Pa.

PRATT, HENRY ZACHARIAH, JR. (Age 54) Senior Civ. Engr., Board of Water Supply, New York, N.Y.

REED, GARNER WADE (Assoc. M.) (Age 43) Civ. Engr., Board of Water Supply, Roscoe, N.Y.

REMINGTON, CHARLES EMMETT (Age 43) Civ. Engr. P-5, U.S. Forest Service, Missoula, Mont.

RUBLE, EMERSON JONAH (Age 44) Structural Engr., Association of American Railroads, Chicago, Ill.

STEELE, JAMES POLK (Age 49) J. P. Steele Constr. Co. (private practice), Laramie, Wyo.

TERENZIO, VINCENT GEORGE (Age 41) Sec. Engr., Board of Water Supply, New York, N.Y.

THOMPSON, FRANCIS THORNTON (Age 48) Civ. Engr. IV, TVA, Chattanooga, Tenn.

VENKATCHARI, ATTUR RANGA (Age 52) Chf. Engr., PWD, Irrigation, Royapettah, Madras, India.

WHITE, WALTER ALLEN (Age 60) Asst. Civ. Engr., New York City Board of Water Supply, Kingston, N.Y.

WHITTEN, EUDELL GARFIELD (Assoc. M.) (Age 38) Civ. Engr., New England Public Service Co., Augusta, Me.

WILLIS, ELLSWORTH BARNETT (Age 50) Sec. Engr., Reservoir Sec., Lackawack Div., Liberty, N.Y.

APPLYING FOR ASSOCIATE MEMBER

ALUISE, ROBERT RICHARD (Age 42) Engr. (Architectural), Office of Chf. of Engrs., U.S. Army, Hospital Design Branch, Washington, D.C.

BENNETT, ALBERT EDWARD (Age 41) Eng. Expediter, Winnipeg Elec. Co., Winnipeg, Man., Canada.

BLOMQUIST, PAUL ERLAND (Age 36) Asst. Civ. Engr., New York City Board of Water Supply, Ellenville, N.Y.

BREWER, JOHN AUGUSTUS (Age 32) Student Instructor, Dept. of Civ. Eng., Kansas State Coll., Manhattan, Kans.

BROGUNIER, CHARLES HENRY (Jun.) (Age 35) Cons. Engr., associated with H. Fryer, Seattle, Wash.

CHLETSOS, ARGYRIOS PANTELIS (Jun.) (Age 28) Structural Designer, Harder, Barbato & Ciampa, New York, N.Y.

CLARK, LUTHER DANIEL (Jun.) (Age 34) Engr., United Constr. Co., Dallas, Tex.

CROOK, LEONARD THOMAS (Jun.) (Age 34) Chf., Contracts, Specifications and Schedules Branch, Panama Canal, Diablo Heights, Canal Zone.

DEADERICK, WILLIAM FRANKLIN (Age 42) Dist. Engr., Arkansas Highway Comm., Dist. No. 1, Dist. Office, Wynne, Ark.

DOBBINS, WILLIAM EARL (Age 35) Engr., Fay, Spofford & Thorndike, Engrs., Boston, Mass.

EAST, EUGENE RAYMOND (Age 32) Structural Engr., P-2, U.S. Dept. of Interior, Bonneville Power Administration, Portland, Ore.

FREEMAN, WALDO DRAKE (Jun.) (Age 34) Hydr. Engr., P-4, U.S. Bureau of Reclamation; Operation and Maintenance Engr., Gila Project and All-American Canal, Yuma, Ariz.

GLASHEEN, RALPH EARLE (Age 54) Asst. to Supt. of Bldgs., Philadelphia (Pa.) Transportation Co., Jenkintown, Pa.

GRAY, DON E. (Age 34) Associate to G. D. Hall, Cons. Engr., Yakima, Wash.

GREINER, ALBERT WILLIAM (Age 40) Associate Constr. Engr., Montana Highway Comm., Helena, Mont.

GRUBER, HOWARD LOUIS JOHN (Jun.) (Age 34) Engr., Fruin-Colnon Contr. Co., St. Louis, Mo.

GULDEMANN, EUGENE JOSSLYN ALLIE (Jun.) (Age 34) Asst. Prof. of Civ. Eng., South Dakota State Coll., Brookings, S.Dak.

HABANS, ROBERT NAGLE (Jun.) (Age 31) Chf. Engr., Orleans Materials & Equipment Co., New Orleans, La.

HALBREICH, HARRY (Age 41) Asst. Civ. Engr., New York City Board of Water Supply, Walton, N.Y.

HAUER, GERALD ELTON (Jun.) (Age 33) Chf. Engr., American Well Works, Aurora, Ill.

HENSLEY, LAURENCE SHERMAN (Jun.) (Age 34) Office Engr. and Concrete Expediter for Bluestone Dam, Bellepoint, W.Va.

HERNANDEZ, JUAN VICENTE (Age 37) Cons. Engr., being member of firm, Leon, Disario, Hernandez, Caracas, Venezuela.

HODGES, DAN ALLEN (Age 40) Engr., Mark K. Wilson Co., Chattanooga, Tenn.

HOLM, ALEXANDER ADAMS (Age 51) Civ. Engr. II, TVA, Knoxville, Tenn.

HOPKINS, PAGE FILMORE (Age 30) Land Surv... Member of firm, Maddox & Hopkins, ... Spring, Md.

INGALLS, EGBERT CYRUS (Age 35) Asst. Pro... Civ. Eng., and Asst. Director of Research, Co... bia Univ., New York, N.Y.

JARVI, ALBERT OTTO (Age 31) Asst. Prof. of ... Eng., Univ. of Washington, Seattle, Wash.

JOE, ALVIN KAY YIP (Jun.) (Age 34) Struc... Engr., Bechtel Corp., San Francisco, Calif.

JOHNSON, THEODORE RANGNOR (Age 42) S... Engr., New York City Board of Water Sup... Downsville, N.Y.

JOHNSTON, CARL BAYARD (Age 32) Engr., Tay... Taylor, Cons. Engrs., Los Angeles, Calif.

KERSTEN, MILES STOKES (Jun.) (Age 34) ... Prof. of Civ. Eng., Univ. of Minnesota, ... neapolis, Minn.

LEWIS, DUDLEY JOSEPH (Age 33) Senior Civ. E... Humble Oil & Refining Co., Houston, Tex.

MCCARTHY, DANIEL VINCENT (Jun.) (Age ... Prin. Engr., Chf., Coordination of Plans ... U.S. Bureau of Reclamation, Washington, ...

MAZUMDER, NARENDRA NATH (Age 36) Sen... Govt. of India for training in plant and ... operation in United States; at present, gra... student, Univ. of Utah, Salt Lake City, Uta...

MILLER, VIGGO (Age 40) Structural Engr., ... Dam Constrs., Mountain Home, Ark.

MITRA, AJIT CHANDRA (Age 30) Asst. Engr., W... & Bldgs. Dept., Govt. of Bengal, assigne... graduate student in Civ. Eng., Univ. of ... Salt Lake City, Utah.

MOWREY, JAMES ABSOLOM (Age 41) Engr. (C... P-3, U.S. Engr. Office, St. Louis, Mo.

MUKHERJEE, SATYA SARAN (Age 32) Dist. E... Bengal Nagpur Ry., Calcutta, India.

MYLAR, DONALD TRAINER (Age 36) Asst. ... Engr., New York City Board of Water Sup... Pepacton, N.Y.

NORTHROP, WILLIAM LAWRENCE (Age 38) E... Hydr., Upper Mississippi River Valley Div... Louis, Mo.

O'CONNOR, ROBERT JOSEPH (Age 38) Asst. ... Engr., New York City Board of Water Sup... Wawarsing, N.Y.

PADDOCK, ERIC C. (Age 45) Project Engr., P... Washington, D.C.; Baltimore, Md.

PEELE, JACK, JR. (Age 32) Major, U.S. Ma... Corps, assigned as Force Intelligence Of... Pacific Fleet, Fleet Post Office, San Franc... Calif.

PEREZ, HENRY TAYLOR (Jun.) (Age 32) Asso... Editor, *Engineering News-Record*, Chicago, I...

PERLEY, WILLIS FREDERICK (Age 31) San. E... Ford, Bacon & Davis, Inc., Argonne Nati... Laboratory, Chicago, Ill.

RIEPE, CARL RIPLEY (Age 32) Asst. Head, Op... tions Div., Sacramento Dist., Corps of En... Sacramento, Calif.

ROCHEFORD, GEORGE EDWARD (Jun.) (Age ... Vice-Pres., L. Rocheford & Son, Inc., Worce... Mass.

ROLLINS, ANDREW PEACH, JR. (Jun.) (Age 29) ... Col., Corps of Engrs., U.S. Army; grad... student, California Inst. of Technology, P... dena, Calif.

SABATINI, EDWARD JOSEPH (Age 47) Field E... Great Lakes Steel Corp., Ecorse, Mich.; W... dotte, Mich.

SAMADDAR, SUHIL KUMAR (Age 28) With Gov... India, Bengal, India, assigned as graduate ... dent, Univ. of Utah, Salt Lake City, Utah.

SEAWORTH, GEORGE HENRY (Jun.) (Age 33) P... P-4 (Civ.), Head of Civ. Eng. Sec. of Dist. M... Design Unit, U.S. Bureau of Reclamation, ... marck, N.Dak.

SLATTEBO, OSCAR INGVALD (Jun.) (Age 34) P... Slattebo-Knox Co., Gen. Contrs., Beverly H... Calif.

SNYDER, CHARLES WILLIAM (Jun.) (Age 34) ... search Associate in San. Eng., Johns Hop... Univ., Baltimore, Md.

SOWLE, JOHN SCHERMERHORN (Age 45) Resi... Steel Detailer, Stevenson & Rubens, Cons. En... Seattle, Wash.

THOMAS, ALBERT COOKE (Jun.) (Age 34) Admi... trative Asst., Senior, Safe Harbor Water ... Corp., Baltimore, Md.

TRAGAKES, CONSTANTINE NICHOLAS (Age 34) S... ior Civ. Engr., Atkinson-Drake-Park, Athe... Greece.

WALING, JOSEPH LEE (Jun.) (Age 32) Asso... Prof. of Eng. Mechanics, Purdue Univ., ... Lafayette, Ind.

WALTERS, PEARL ARTHUR (Age 38) Struct... Engr. P-3, U.S. Engr. Office, Kansas City, M...

WEBER, ROY EDWARD (Age 32) Office Engr. ... George S. Brockway, Cons. Engr., West P... Beach, Fla.

WILSON, JAMES MALCOLM (Jun.) (Age 34) Desig... Squad, Job Leader, Black & Veatch, Cons. En... Kansas City, Mo.

Lower Excavation Costs

YOU CAN COUNT ON minimum excavation costs with Transite* Sewer Pipe because Transite has an exceptionally high flow capacity (n=.010). This often permits the use of flatter grades and shallower trenches. This is a particularly important advantage where rock excavation is involved or where the pipe must be laid at or below the ground water line.

As an alternate economy, designers often take advantage of Transite's high flow capacity by specifying smaller diameter pipe.

Transite Offers Other Economies, Too. Right from the start, this pipe helps you cut sewage disposal costs. Transite's long 13-foot lengths and light weight mean lower handling costs. And fewer joints to assemble in the finished line result in faster, more economical installation.

Transite Reduces Treatment Costs. As a further economy, tight sleeve-type joints guard effectively against infiltration . . . reduce the load on the treatment plant. Thus, treatment costs are kept low . . . and plant capacity can be conserved for the increased loads incident to future community growth.

Transite Cuts Maintenance Costs. Made of asbestos and cement combined into a homogeneous material of great stability, Transite Sewer Pipe is corrosion-resistant both inside and outside. Tight joints safeguard against root trouble. And every Transite length is factory-tested for strength and uniformity. This adds up to low annual maintenance costs through the years.

Get All The Facts About Transite. If you are seeking ways to lower sewage disposal costs, you'll be interested in the many economies Transite Sewer Pipe can offer you. Send for free brochure containing further engineering data. Address Johns-Manville, Box 290, New York 16, N. Y.

*U. S. Pat. Off.

Johns-Manville

JOHNS MANVILLE JM PRODUCTS

Transite Sewer Pipe

WITT, ROBERT PAYNE (Age 37) Instructor in Civ. Eng., Oklahoma A. & M. Coll., Stillwater, Okla.

WOLFGANG, JOHN LEONARD (Age 41) Chf., Control of Planning Progress Sec. (Engr. P-6), Bureau of Reclamation, Washington, D.C.

YOUNG, SAMUEL RICHARD (Jun.) (Age 32) Asst. Dist. Airport Engr., CAA, Montgomery, Ala.

APPLYING FOR JUNIOR

BHARUCHA, JAL NARIMAN (Age 23) Graduate student, Univ. of Michigan; previously Asst. Constr. Engr., Messrs. Pallonjee Eduljee & Son, Bldg. Contrs. and San. Engrs., Ann Arbor, Mich.

BROOKE, CARL KENNETH (Age 29) Airport Engr., being Supervisor or Company Representative, Pan American Airways, Inc., New York, N.Y.

BRYAN, ALBERT HENRY, JR. (Age 29) Research Engr. (Physicist), Carbide & Carbon Chemicals Corp., Oak Ridge, Tenn.; at present, graduate student, Massachusetts Inst. of Technology, Cambridge, Mass.

ESVELT, JOHN PETER (Age 26) With Weyerhaeuser Timber Co., Tacoma, Wash.

GOLDEMBERG, JAIME (Age 25) Graduate student, Univ. of Washington, Seattle, Wash.

KANNAN, THAKKOLAM SENTHAMARAI (Age 26) Sec. Officer, Design Office, Govt. of Madras, Chepauk, India; George Town, Madras, India.

MCLAURIN, BANKS, JR. (Age 24) Civ. Engr., Humble Oil & Refining Co., Kingsville, Tex.

MAHONEY, WILLIAM HARDEE (Age 26) Instructor, Dept. of Civ. Eng., Mich. State Coll., East Lansing, Mich.

MARLEY, JAMES PATRICK (Age 30) Engr., Port of New York Authority, New York, N.Y.

MAUCH, CLAIR ALLEN LAVERNE (Age 25) With Black & Veatch, Cons. Engrs., Kansas City, Mo.

MELEYCO, VICTOR N. (Age 29) San. Engr., Constr. Div., Corps of Engrs., U.S. Army, Frankfurt, Germany.

MOHAN, DINESH (Age 25) Senior Scientific Officer, Bldg. Research Unit, Council of Scientific and Industrial Research, Roorkee, India.

NESTER, JAMES THOMAS (Age 25) Superv. Engr., U.S. PRA, Philippine Islands Div., American Embassy, care, P.M., San Francisco, Calif.

RONCAVOLO, LUIS ALBERTO (Age 29) Chf. of Dept. of Iron & Steel, Dept. of Tech. Services, Corporacion Venezolana de Fomento.

SEAVER, GEORGE ARTHUR, JR. (Age 25) Civ. Engr., Boh Bros. Constr. Co., New Orleans, La.

SHEPARD, EUGENE NELSON (Age 30) With Gulf Refining Co., Cleves, Ohio.

STAHL, FRANK LUDWIG (Age 28) Designer with O. H. Ammann, New York City; Long Island City, N.Y.

WYDE, EDWIN LOUIS (Age 23) Designing Engr., The Texas Co., Port Arthur, Tex.

ALA. POL. INST.

	(AGE)
BURGE, ARTHUR CREW, 1948	(27)
HODGES, CLARENCE MILTON, 1948	(26)
JONES, LAURIS TAYLOR, 1948	(25)
MAIN, SAMUEL WILTON, 1948	(25)
MORGAN, GROVER A., JR., 1948	(24)
RUSSELL, ROBERT C., 1948	(26)
WALLACE, ROBERT HENRY, 1948	(26)
WILLIS, WILLIAM THOMAS, 1948	(24)

UNIV. OF ARIZ.

BOWLES, ALBERT MORSE, JR., 1948	(24)
CORTEZ, JOSEPH DEMETRIO, 1948	(31)
CREIGHTON, DAVID EDWARD, JR., 1948	(23)
HAMMOCK, MURRAY, LLOYD, 1948	(27)
HOLMQUIST, LARS, 1948	(28)
HOWE, DANIEL REA, 1948	(27)
JONES, MYLES REY, 1948	(25)
LUSTER, CHARLES KAY, 1948	(22)
MENDENALL, HAROLD ORMAN NEIL, 1948	(29)
PICKETT, ANDREW GREER, 1948	(26)
SANDLIN, ELLIS FRED, 1948	(27)
WALKER, WARREN D., 1948	(26)
WALLACE, JAMES ALEXANDER, JR., 1948	(25)
WATSON, JOHN BURKE, 1948	(25)
WHITE, ALSON PHAROAH, JR., 1948	(25)
WHITE, STERLING FREDERICK, 1948	(27)

UNIV. OF BRITISH COLUMBIA (AGE)

GRAY, ROBERT VERNON, 1948	(23)

BROOKLYN POLY. INST.

KUMMERLE, EUGENE RICHARD, 1948	(21)

CALIF. INST. TECH.

AGHBABIAN, MIHRAN, 1948	(24)
BEINSCHROTH, ADAM JACK, 1948	(24)
BINGHAM, ANDREW THOMAS, 1948	(24)
BLAIR, JOHN MARVIN, 1948	(26)
BOTTS, EMMETT MACDOWELL	(23)
BREECE, ROBERT KING, 1948	(25)
BUTLER, STUART MARKLE, 1948	(24)
CARROLL, WILLIAM JEROME, 1948	(24)
DALTON, ROBERT DOCK, JR., 1948	(23)
DAVIS, JAMES ROBERT, 1948	(24)
DAVIS, RUSSELL LATHROP, 1948	(22)
GASKELL, ROBERT CHRISTOPHER, 1948	(30)
HARRISON, WARREN DEARMOND, 1948	(25)
HAUSMANN, DELBERT ARTHUR, 1948	(24)
HYBERTSON, HORACE MARTIN, 1948	(30)
LAMBERT, PETER CHARLES, 1948	(24)
LUNDY, WILLIAM PEARSON, 1948	(27)
LYNN, ROBERT CARL, 1948	(23)
MARTIN, JAMES EUGENE, 1948	(29)
MOORE, HARRY JAMES, JR., 1948	(25)
POND, MARSHALL CLARKE, 1948	(30)
RICHEY, EUGENE PORTER, 1948	(31)
ROE, GEORGE WINTON, 1948	(20)
SKOGSTAD, LEIF, 1948	(27)
SULMEYER, IRVING IRA, 1948	(21)
WATERS, ALFRED EARNEST, 1948	(24)
WONG, ALBERT KOON-BIU, 1948	(25)
WILLIAMS, JOE KEITH, 1948	(25)

CASE INST. TECH.

ABIDI, ASGHAR ALI, 1948	(25)
KOMINEK, HENRY VICTOR, 1947	(25)

THE CITADEL

BARNES, JOHN WERNER, 1948	(22)
ENCK, THOMAS WATKINS, 1948	(26)
GRAVES, CHARLES BRYANT, JR., 1947	(23)
JENKINS, JOHN HEYWARD, 1948	(27)
MANION, EDWARD PETER, 1948	(24)
MCCORMICK, FRANCIS MILLER, 1948	(23)

CLEMSON A. & M. COLL.

GERVAIS, JOHN LEWIS, JR., 1948	(23)
MOSS, ALEX ANDREW, 1948	(24)
PEEK, JAMES MARION, 1948	(26)
STEPHENS, WILLIAM KERR, 1948	(23)
SUMMER, OSCAR RAYMOND, JR., 1948	(26)
TROTT, CAMBRIDGE MUNRO, JR., 1948	(23)
WEBB, JOE EMERSON, 1948	(24)

COLO. A. & M. COLL.

BREZINA, GRANT ALBERT, 1947	(29)
KROLL, KENNETH HENRY, 1948	(26)

UNIV. OF COLO.

ANDERSON, ROBERT RAY, 1948	(22)
CASE, HAROLD WATKINS, JR., 1948	(28)
CASTO, RICHARD WAYNE, 1948	(25)
COLLIER, WILLIAM THURMOND, 1948	(21)
CUMMINGS, RICHARD LEE, 1948	(29)
DEARTH, KEITH HERNDON, 1948	(25)
EHLERS, KENNETH DALE, 1948	(22)
GIBBS, ALBERT EDWIN, 1948	(27)
HANEY, LEWIS CHARLES, 1948	(24)
HASTINGS, JAMES MCMILLAN, 1948	(25)
HAYWARD, PAUL VICTOR, 1948	(22)
HESTER, PASQUAL EDWIN, 1948	(23)
HEUBNER, ALLEN DOWLING, 1948	(22)
JONES, KENNETH WARREN, 1948	(22)
KNICKERBOCKER, HUGH IRWIN, 1948	(22)
MCINTOSH, WALTER COLMAN, 1948	(27)
MARSHALL, WARREN STANLEY, 1948	(24)
NICHOLSON, LELAND WESLEY, 1948	(23)
RUST, QUENTIN, 1948	(26)
THORNBURGH, JACK MAYNARD, 1948	(21)
UHRICH, ROBERT HAROLD, 1948	(27)
VOSS, EDWIN HENRY, 1948	(22)
WILLIAMS, CLAYTON GEORGE, 1948	(28)
YOUNGCLAUS, GEORGE DUNTON, 1948	(27)
ZERSCHLING, KEITH LEE, 1948	(22)

COLUMBIA UNIV.

APPEL, DANIEL JOSEPH, 1948	(24)
NOVICK, DAVID AARON, 1948	(22)

CORNELL UNIV.

PEI, MINGLUNG, 1948	(25)

UNIV. OF DELAWARE

TYNDALL, JOSEPH THOMAS, 1948	(27)

DREXEL INST. TECH.

MITNICK, MITCHELL, 1948	(23)
WAGNER, FRANCIS HOWARD TORRANCE, 1947	(24)

UNIV. OF FLA.

HIGGINS, BEN THOMAS, 1948	(25)
WHITESIDE, AUGUSTUS FRANCIS, 1948	(25)

THE GEORGE WASHINGTON UNIV.

BALMER, HARRY ARNOLD, 1948	(32)
KOUTSANDREAS, PETER DIONYSIOS, 1948	(22)

GEORGIA INST. TECH.

CLARK, GEORGE WILLIAM, 1948	(28)
EAST, CLAIBORNE POWELL, 1948	(26)
LONG, EDGAR COTTER, JR., 1948	(21)
LUCAS, JAMES EDWARD, JR., 1948	(25)
MOORE, JAMES WILKINSON, 1948	(26)
NOVAK, ROBERT LOUIS, 1948	(20)
ROGERS, HERBERT HAROLD, 1948	(27)

HARVARD UNIV.

CRUMRINE, KENNETH DAY, 1947	(22)

UNIV. OF IOWA

ERICKSON, ROBERT FREDERIC, JR., 1948	(28)

JOHNS HOPKINS UNIV.

CARTON, ALLEN MARVIN, 1948	
COLLINS, STEPHEN EDWARD, 1948	
GATTENS, JAMES HUGH, 1948	
LEVIN, GILBERT VICTOR, 1947	

KANS. STATE COLL.

BAIER, ROBERT LEWIS, 1948	
BARNETT, IRVIN STANLEY, 1948	
COWAN, BENN, 1948	
FULLER, RICHARD MARTIN, 1948	
JAMES, STEPHEN KELLY, 1948	
JOHNSON, PAUL AUGUST, 1948	
JORGENSON, PAUL HARRISON, 1948	
LEAIRD, DICK DILLON, 1948	
LINDHOLM, ERNEST ALFRED, 1948	
MAHONEY, GEORGE TERRENCE, 1948	
MUCHOW, ROBERT LEONARD, 1948	
PETERSON, LOYD EDWIN, 1948	
ROBERTS, JOHN MORRIS, 1948	
TACKETT, CECIL EMERY, 1948	
TJADEN, MAURICE EARL, 1948	
WARD, LINTON EDWARD, 1948	
YOUNG, DEWEY HERMAN, 1948	

LA. STATE UNIV.

ALLEN, JAMES EDWIN, 1948	
EDRINGTON, WILLIAM EMMETT, JR., 1948	
HERON, THOMAS AGUSTAS, JR., 1948	

UNIV. OF MARYLAND

FORSYTH, JAMES CLARK, JR., 1948	

MICH. COLL. OF MIN. & TECH.

JOHNSON, HARVEY GLENN, 1948	
KELLY, WILLIAM HENRY, 1948	
KUCHTA, SAMUEL WILLIAM, 1948	
LAPISH, ARTHUR PHILIP, 1948	
MACRAE, DONALD THOMAS, 1948	
MCKENZIE, GEORGE HENRY, 1948	
URBANIAK, ALEX S., 1948	

MICH. STATE COLL.

PEARCE, RALPH MAYNARD	
SWANSON, RICHARD WAYNE	

UNIV. OF MINN.

GRIER, HAROLD EUGENE, 1948	

MISS. STATE COLL.

DEMPSEY, JOHN MARION, 1948	
FORTEMBERRY, JAMES CALVIN, 1948	
FOSTER, JAMES EDWARD, 1948	
HILL, CHARLES WALLACE, 1948	
HUFF, WILLIAM WILSON, 1948	
JAMES, J. H., JR., 1948	
KEEN, HILTON, 1948	
KLYCE, JOHN HUBERT, 1948	
MEUX, WILLIAM LEIGH, JR., 1948	
MOSELEY, HOWARD NORMAN, JR., 1948	
PEVEY, MOTT LOCKWOOD, JR., 1948	
STEEN, JAMES BURKETT, 1948	
STROUD, RALPH LANIER, 1948	
THOMPSON, BILLY JIM, 1948	
WILLIAMS, MILTON LANE, 1948	
WOLEBEN, WILBUR HARRY, 1948	

MO. SCHOOL OF MINES & MET.

BERMEL, PETER FRANK, 1948	
BOTT, WINSTON FREDERICK, 1948	
COLLAR, DONALD HARVEY, 1948	
EAST, JOE CHARLES, 1948	
ELLIS, MAURICE HARLAND, 1948	
LEAVER, HARVEY BEERS, 1948	
MOE, HAROLD GILBERT, 1948	
O'NEILL, LAWRENCE FREDERICK, 1948	
RHOADS, DONALD EUGENE, 1948	
SPINZIG, EDGAR WALTER, JR., 1948	
SWENTEK, RAYMOND HARRY, 1948	
WARREN, GLENN WINDSOR, 1948	

MONTANA STATE COLL.

BERWICK, VERNON KENNETH, 1948	
BRAZIEL, KENNETH RICHARD, 1948	
DOLAN, THOMAS AUSTIN, 1948	
EDDY, JAMES ARTHUR, 1948	
GRANLEY, EDWIN CALVER, 1948	
HOFFMAN, GEORGE FRANK, 1948	
LIKES, ELMER H., 1948	
LORELL, WILLIAM WOLFGANG, 1948	
LORENZEN, LEWEY HENRY, 1948	
NYMAN, FRANK EDMOND, 1948	
PERSSON, LESTER CARLOS, 1948	
POIRIER, PAUL EDWARD, 1948	
RENNICK, KENNETH BROWN, 1948	
SCHLEPP, HOWARD WILLIAM, 1948	
SITZMAN, HAROLD SAM, 1948	
STEWART, DOUGLAS GORDON, 1948	
STOKKE, MELVIN ALFRED, 1948	
WALTON, CHARLES FRANCIS, 1948	
WILLIAMSON, ALBERT EDWARD, 1948	

UNIV. OF NEV.

BLAIR, EDGAR WAYNE, 1948	

COLL. OF CITY OF N.Y.

FINERMAN, AARON, 1948	
LEVINE, FRED JACOBUS, 1948	

Always On Guard Against Fire . . .

In today's modern plants, the first line of defense against fire is an automatic sprinkler system . . . with a dependable gravity water supply stored in an elevated water tank. Water provided by an elevated tank is always ready to go, thus giving you constant protection.

The Horton elevated tank shown above is a 150,000-gal. structure at the Aluminum Corporation of America's Hillside, Illinois, plant. This completely new plant is designed for the production of die castings for the midwestern market. The storeroom and shipping department are protected by an automatic sprinkler system, all the heads of which are served by the elevated tank.

The tank is piped for dual service. One hundred thousand gallons of its capacity is held in reserve at all times as a primary supply for fire protection. The remaining 50,000 gals. is used for die cooling, oil and water cooling, boilers and general plant needs. General service requirements, about 40,000 gpd, are replaced by an automatically-controlled deep-well pump with a capacity of 250 gpm. The source of the water supply is a 1500-ft. drilled well.

Horton ellipsoidal-bottom elevated tanks, like the one above, are built in standard capacities from 40,000 to 250,000 gals. for use with automatic sprinkler systems. To meet a wide variety of industrial and municipal uses, Horton tanks are available with hemispherical bottoms and ellipsoidal bottoms in capacities from 5,000 to 500,000 gals.; with radial-cone bottoms, from 500,000 to 2,000,000 gals.; and in special spherical and spheroidal designs.

Our new booklet "Horton Ellipsoidal-Bottom of Welded Construction Elevated Tanks" tells the full story of elevated storage and what it may mean to you. Write our nearest office for your copy.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4 . . . . . 2199 McCormick Bldg.	Havana . . . . . 402 Abreu Bldg.	Tulsa 3 . . . . . 1647 Hunt Bldg.
Cleveland 15 . . . . . 2263 Guildhall Bldg.	Philadelphia 3, . 1652-1700 Walnut St. Bldg.	Birmingham 1 . . . . . 596 N. 50th Street
New York 6. . . . 3395—165 Broadway Bldg.	Atlanta 3 . . . . . 2167 Healey Bldg.	San Francisco 11 . 1284-22 Battery St. Bldg.
Houston 2 . . 2128 National Standard Bldg.	Detroit 26 . . . . . 1541 Lafayette Bldg.	Los Angeles 14 . . . . . 1456 Wm. Fox Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

N.Y. UNIV. (AGE)

SECOF, SAMUEL, 1947 (24)

N.DAK. AGRI. COLL.

FISK, GARRY LEE, 1948 (24)

UNIV. OF N.DAK.

COLBERT, JESSE LANE, 1948 (25)

NORTHEASTERN UNIV.

BRAMAN, DANIEL EDWARD, 1948 (20)

OHIO STATE UNIV.

FOSTER, SAMUEL LEROY, JR., 1948 (25)
LAUGHTON, FREDERICK STUART, 1948 (32)
OWEN, CALVIN PENCE, 1948 (25)

UNIV. OF OKLA.

ABBOTT, LLOYD WALDEN, 1948 (25)
BEENE, RALPH ROBERT WILLIAM, 1948 (22)
CARNEY, JOHN BRYAN, JR., 1948 (27)
COON, EDWARD MCKINNON, 1948 (25)
CORNETT, JACK BURKE, 1948 (28)
DORRIS, ALLEN DEAN, 1948 (24)
GEORGE, ROBERT HERSCHEL, 1948 (25)
GLASS, ELLIOTT MARLOW, 1948 (23)
HUDSON, EDWARD EVERETT, JR., 1948 (25)
HUNT, WALLACE LESTER, 1948 (23)
JARRETT, ROBERT PATTERSON, 1948 (25)
NEWTON, CHARLES DELMER, 1948 (26)
PORTER, THOMAS ARTHUR, 1948 (27)
RIMMER, HARRY LEE, JR., 1948 (22)
SAYLES, CLINTON ALLEN, 1948 (27)
SCHALLER, MALCOLM GUY, 1948 (25)
WEEKS, HOMER ALDREDGE, 1948 (25)
WELCH, GLENN FRANKLIN, 1948 (27)

PA. STATE COLL.

CURTIN, HARRY HOLTER, 1947 (28)

PURDUE UNIV.

BUGG, STERLING LOWE, 1948 (28)

R.I. STATE COLL.

KINGSFORD, SYLVIA MABELLE, 1948 (21)

THE RICE INST. (AGE)

BOY, WILLIAM LINCOLN, 1948 (24)
BROYLES, WILLIAM DODSON, 1948 (22)
BUCKLEY, JACK BOYD, 1948 (22)
CAMPBELL, ROY EDWIN, 1948 (21)
CHAPMAN, LAWRENCE EVANS, JR., 1948 (24)
COLLINS, ROBERT WAYNE, 1948 (23)
DAYTON, ROBERT COWAN, 1948 (26)
GIEBEL, EDWIN LOUIS, 1948 (27)
GRIMES, ROBERT OWEN, 1948 (28)
HILL, JOHN FRANCIS, JR., 1948 (21)
HUDSON, ROBERT DONALD, 1948 (23)
LEHN, EDWARD THOMAS, JR., 1948 (21)
MURPHY, WALTER DEWITT, 1948 (26)
PETERSON, GEORGE ALFRED, 1948 (24)
RAINEY, DAVID TOWNSEND, 1948 (23)
READ, ROBERT LEE, 1948 (22)
STONESTREET, HARDEMAN LEWIS, 1948 (23)
STILLMAN, GEORGE SHAW, 1948 (21)
VOGT, ELWOOD WAYNE, 1948 (26)

UNIV. OF S.C.

MCGRATH, JOHN FRANCIS, 1948 (24)
MILLER, DAN FRANK, JR., 1948 (27)
SEXTON, CLARENCE DANIEL, JR., 1948 (21)

S.DAK. SCHOOL OF MINES & TECH.

SOLHEIM, ROBERT LESTER, 1948 (26)

S. DAK. STATE COLL.

ANDERSON, ROBERT HARRY, 1948 (27)
BOARD, LESTER CARLYLE, 1948 (30)
CORNELIUS, HENRY ALLEN, JR., 1948 (23)
MERBACH, RUSSELL NORTON, 1948 (23)
PETERSEN, GILBERT FRED, 1948 (24)
PHILLIPS, DAVID LENHART, 1948 (24)
PRUNTY, JAMES VICTOR, 1948 (25)
ROGNESS, AARON NICHOLAS, 1948 (24)
SANDVIG, LEO DELL, 1948 (24)

STANFORD UNIV.

COLLINS, JOHN HAMILTON, 1948 (25)
RILEY, JOHN WINTON, 1948 (25)
SIMPSON, ALBERT THOMAS, 1948 (25)

SWARTHMORE COLL.

BASSETT, EDWARD MORRIS, JR., 1948 (26)
GARY, JOSEPH, 1948 (26)

HOUTMAN, JOHN EDWARD, 1948 (AGE)
HURD, RICHARD MERRITT, 1948 (22)
STEARNS, WHITNEY KNEELAND, 1948 (24)
WHITMAN, ROBERT VANDUYNE, 1948 (24)

SYRACUSE UNIV.

FILKINS, CHARLES HENRY, 1948 (20)

TEX. A. & M. COLL.

LANE, ROBERT EDWARD, 1948 (24)
PORTER, DAVID HERBERT, JR., 1948 (20)
SMITH, JAMES ARNOLD, 1948 (20)
WORTHAM, MILES FRANK, 1948 (24)

UNIV. OF TEX.

JONES, KENNETH ROWLAND, 1948 (24)

TULANE UNIV.

CAMP, CHARLES ROLLIN, JR., 1948 (21)
CREWS, ROBERT NELSON, 1948 (24)
HEROY, FRANK MELVILLE, JR., 1948 (21)
SLOVENKO, RALPH, 1948 (21)

UNIV. OF VT.

JENKINS, STEARNS RAYMOND, 1948 (24)

VA. POLY. INST.

ROGERS, GROVER LEE, 1948 (21)
SAUNDERS, GLENN WILLIAM, JR., 1948 (20)

STATE COLL. OF WASH.

CASEBELT, GEORGE CLIFFORD, 1948 (20)

UNIV. OF WASH.

GANGNATH, HAROLD LEWIS, 1948 (27)
HALVORSON, RAYMOND OTTO, 1948 (26)
JORGENSEN, JACK CHRISTIAN, 1948 (24)
KRAMER, LEGION CHARLES, 1948 (27)
LADD, HARRY HARPER, 1948 (23)
LEWIS, KENNETH EMERSON, 1948 (21)
MCELENEY, PHILIP JEROME, 1948 (21)
MCHUGH, CHARLES WILLIAM, 1948 (24)
THOMPSON, DAVID PAINE, 1948 (24)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

From May 10 to June 9, 1948

Additions to Membership

ADAMS, DONALD EVANS (Jun. '48) Sales Engr., The Hallen Co. Inc., 45-24 Thirty-seventh St., Long Island City (Res., 188-04 Sixty-fourth Ave., Flushing, L.I.), N.Y.

ADAMS, FREDERICK SHIELDS (Jun. '47) Instr., Univ. of New Mexico, Civ. Eng. Dept. (Res., 1616 East Silver Ave.), Albuquerque, N.Mex.

ANDERSON, DONALD ARTHUR (Jun. '48) City Planning Engr., I.S. Shattuck, Traffic and Planning Consultant, City Hall (Res., 540 Park Ave.), Albert Lea, Minn.

ANDROITIS, THEODORE MICHAEL (Jun. '47) Asst. Engr., Atkinson-Drake-Piper, 25 Broad St., New York, N.Y. (Res., 1241 North Potomac St., Baltimore, Md.)

ARMSTRONG, ARGYLE EDWARD (Assoc. M. '48) (Armstrong & Armstrong Engrs. & Contr.), P.O. Box 59, Wenatchee, Wash.

ASH, ROBERT B. (Jun. '47) Vice-Pres., L. R. MacKenzie Inc., 625 S.W. 9th St., Des Moines, Iowa.

BAER, JAMES FRANCIS (Jun. '48) Design Engr., G. S. Richardson, Cons. Engr., 901 Park Bldg. (Res., 2961 Mattern Ave.), Pittsburgh 16, Pa.

BAKER, WALTER FRANKLIN (Jun. '48) Operations Trainee, Shell Oil Co., Inc., 1221 Locust (Res., 4924 Buckingham Court), St. Louis 8, Mo.

BANERJEE, BINAY KUMAR (Jun. '48) Civ. Engr., Govt. of India, 2111 Massachusetts Ave., N.W., Washington, D.C.

BARNES, WADE ELLISON (Jun. '48) Design and Layout of Paper Mills, Charles T. Main, Inc., 80 Federal St., Boston, Mass. (Res., 151 Concord St., Nashua, N.H.)

BAUER, WILLIAM JOHN (Jun. '48) Partner (Bauer & Davis, Constr. Co.), 603 College St., Iowa City, Iowa.

BEEZLEY, NATHANIEL WILLIARD (Jun. '48) Junior Engr., Office of the City Engr., City Hall (Res., 420 North 27th St.), Lincoln 3, Nebr.

BELL, GEORGE EDWIN (Jun. '47) 1116 Grace St., San Leandro, Calif.

BERKOWITZ, MORRIS (Jun. '48) Civ. Engr., American Bridge Co., Trenton (Res., 23 Bloomfield Ave., Flemington), N. J.

BERRY, NARENDRA KUMAR (Assoc. M. '48) Care, Education Dept., Office of High Commr. for India, India House, London, England.

BIRD, MERRILL WHITING, JR. (Jun. '47) Junior Engr., The Duncanson-Harrelson Co., 1404 de Young Bldg., San Francisco (Res., 2406 Dana St., Berkeley 4), Calif.

BISHOP, JOHN WILLIAM (Jun. '48) Sales Engr., Marion Power Shovel Co., Dept. 100, Marion, Ohio.

BLOWERS, JAMES ERNEST (Jun. '48) Junior Engr., New York Fire Insurance Rating Organization, 400 East Genesee St., Syracuse, N.Y.

BLUMBERG, ABRAHAM (Jun. '48) Engr. Draftsman, Jacob Feld, Ph.D., 60 East 23d St., New York (Res., 422 Saratoga Ave., Brooklyn 33), N.Y.

BORDEN, OLNEY (M. '48) Cons. Engr., 109 Dwyer Ave., Liberty, N.Y.

BOTTS, CARLOS FLETCHER (Jun. '48) Asst. Civ. Engr., State Dept. of Conservation, 7 North Bainbridge St., Montgomery 4, Ala.

BROADY, HARRY WILLIAM (Jun. '48) Civ. Engr., Stone & Webster Eng. Corp., Boston, Mass. (Res., 115 Halstead St., East Orange, N.J.)

BROWN, HENRY FRANKLIN (M. '48) Dist. Engr., Northern Pacific Ry. Co. (Res., 903 Goodrich Ave.), St. Paul 5, Minn.

BURDIN, EDWARD FRANCIS (Assoc. M. '48) Civ. Engr., U.S. Engr. Office, Corps of Engrs., Care, U.S. Engr. Office (Res., 2004 Wolcott Ave.), Wilmington, N.C.

BURRELL, THOMAS, JR. (Jun. '48) Rodman, New York Central R.R., Rm. 1058, 466 Lexington Ave., New York, N.Y.

BUTTERFIELD, PEARCE ROBERT (Jun. '48) Junior Engr., Phillips Petroleum Co., Box 718, Austin, Tex.

CAHILL, HAROLD PHILIP (Jun. '47) Ensign, Civ. Engr. Corps., U.S. Navy, Public Works Dept., NAS, Alameda, Calif.

CARPENTER, JOHN SOLOMON (Assoc. M. '48) Asst. Dist. Engr. for Constr., Federal Works Agency, Bureau of Community Facilities, 2933 Barium Tower (Res., 671 Lakewood Blvd.), Detroit 15, Mich.

CAVCI, MACIT AHMET (Jun. '48) Special Research Graduate Asst., Univ. of Illinois, 117 Talbot Laboratory, Urbana, Ill.

CHAPMAN, JAMES THOMAS (Jun. '47) Design Engr., City of Corpus Christi, Dept. of Public Works (Res., 202 West Roosevelt,) Corpus Christi, Tex.

CHAR, STANLEY FAH KONG (Jun. '48) Graduate Student, Univ. of Illinois, 1361 Euclid St., Champaign, Ill.

CHATTERJEE, RANJIT MOHAN (Jun. '48) Asst. Engr., Commrs. Port of Calcutta, Care, Chf. Engr., 15 Strand Rd., Calcutta, India.

CHRISTENSEN, RULON C. (Jun. '47) Junior Engr., H. E. Ridd and Sons Builders, 1961 East 48th South, Salt Lake City 7, Utah.

CLOVE, FRANK EPHRIAM (M. '48) Civ. Engr., City of Los Angeles, 608 City Hall, Los Angeles 12, Calif.

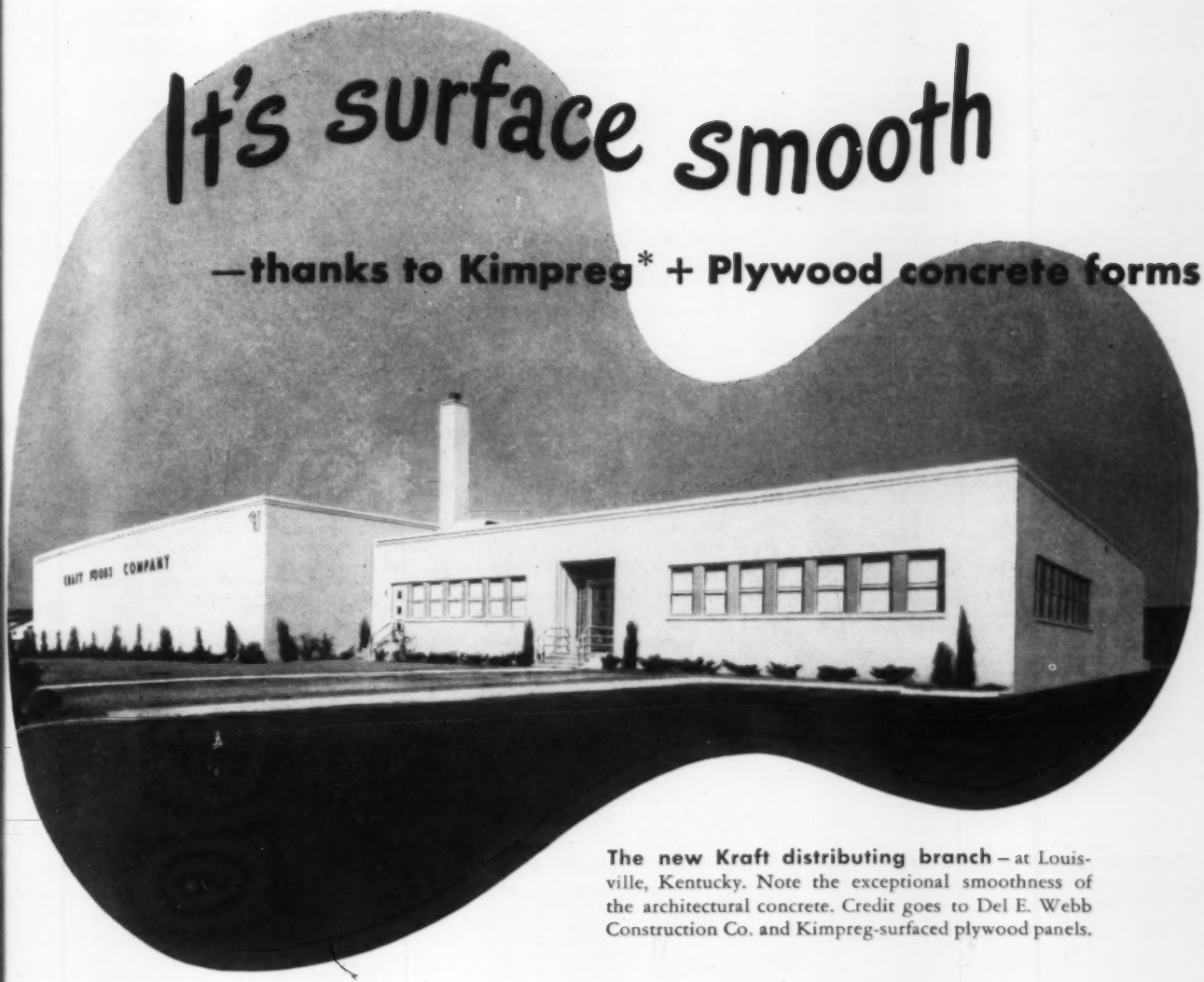
COHEN, ALVIN (Jun. '48) Junior Civ. Engr., New York City Tunnel Authority, 10 State St., New York (Res., 375 Midwood St., Brooklyn), N.Y.

COOLEY, RICHARD PATTISON (Jun. '47) 4053 Second Ave. N.E., Seattle 5, Wash.

COOPER, JOHN WALLACE (Jun. '48) Estimator, Gen. Bldg., Contr., J. W. Bateson Co., Inc., 1102 Irwin-Keasler Bldg. (Res., 6900 Lovett Ave.), Dallas, Tex.

It's surface smooth

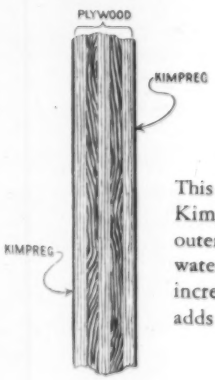
—thanks to Kimpreg* + Plywood concrete forms



The new Kraft distributing branch – at Louisville, Kentucky. Note the exceptional smoothness of the architectural concrete. Credit goes to Del E. Webb Construction Co. and Kimpreg-surfaced plywood panels.

Surfaces are smooth, attractive. Kimpreg* plastic surfacing is a hard, flint-like material that is bonded to plywood in manufacture. Its phenolic resin facing produces a remarkably even, long lasting concrete finish. Lessens rubbing down labor.

Maintenance expense cut. Plywood forms protected with Kimpreg resist the abrasion of sand, gravel and cement. On the Kraft project, these panels used a minimum of oil. They stripped fast – cleaned quickly. Light in weight and durable, they were easily moved, safely shipped to another job.



This sectional view shows how Kimpreg surfaces are fused to the outer layers of plywood. A tough, water-resistant sheathing, Kimpreg increases the abrasion resistance – adds to the life of plywood.

Ultimate cost of the forms reduced. Handled with reasonable care, Kimpreg-surfaced plywood panels can be re-used many, many times. They're unaffected by rain, or snow, or temperature extremes.

Panels are easily constructed. These versatile panels can be sawed, drilled or nailed to erect any size form desired. They're available through your local plywood jobber; are also sold by individual plywood manufacturers under the trade name Laminex, Inderon and Westboard Industrial Plastic. For full information, write us on your business letterhead.

KIMBERLY-CLARK CORPORATION
Plastics Division Neenah, Wisconsin

Kimpreg
REG. U.S. PAT. OFF.
PLASTIC SURFACING

A PRODUCT OF Kimberly Clark RESEARCH

*TRADEMARK Reg. U. S. Pat. Off.

CORREAL, HERNANDO (Jun. '48) Civ. Engr., Chf. of Laboratory for Water Analysis, Govt. of Columbia, S.A. Edif. Resistancia de Materiales, Ciudad Univ. (Res., Calle 15 #9-55), Bogota, Columbia, S.A.

CROLL, DONALD (Assoc. M. '48) Engr., Corps of Engrs., Bridge St. (Res., 74 Hedley Place), Buffalo 8, N.Y.

DAGDELEN, OGUZ (Jun. '48) Box 601, Station A, Champaign, Ill.

DAGGETT, VAUGHAN MERRILL (M. '48) Engr., State Highway Comm., State House (Res., 22 Drew St.), Augusta, Me.

DAVIS, THENTON LOWELL (Assoc. M. '48) Chf. Draftsman, Sinclair Refining Co., Southeastern Dist., 573 West Peachtree St., N.E., Atlanta (Res., 140 Winnona Drive, Decatur), Ga.

DAY, WARREN JAMES (Jun. '48) Graduate Student, Civ. Engr., Univ. of Illinois, 1215 South Fourth, Champaign, Ill.

DE ARRIETA, JOHN (Jun. '48) Structural Engr., Wright Bldg. (Res., 5948 Twelfth Ave.), Sacramento 17, Calif.

DEDOLPH, KARL, JR. (Jun. '47) Missouri Valley Constr. Co., Warren, Mont.

DEMAREST, GARRETT WILLIAM (Jun. '47) 2156 Mendocino Lane, Altadena, Calif.

DORON, PAUL HERMAN (M. '48) Asst. Gen. Mgr., The Palestine Water Co., Ltd , 13 Achad Haam St., Tel-Aviv, Palestine.

DUKE, JESSE CHISHOLM (Jun. '47) Structural Engr., Skidmore, Owens & Merrill, 305 East 63d St., (Res., 765 Home St.), New York, N.Y.

DUNCAN, JAMES LEVERIDGE (Assoc. M. '48) Engr., Pritchard & Abbott, 504 Century Bldg., Fort Worth, Tex.

EGGENBERGER, BYRNE (Jun. '47) Teacher, John Muir College, 1905 Lincoln Ave., Pasadena (Res. 3565 McNally Ave., Altadena), Calif.

EKBLAD, WILLIAM OSCAR (Jun. '48) Civ. Engr., Corps of Engrs., 10 East 17th St. (Res., 3529 Charlotte St.), Kansas City, Mo.

EMERY, AUSTIN HART (Jun. '48) Graduate Student, Teaching Asst., Rensselaer Polytechnic Inst., Troy Bldg. (Res., 10 North Lake Ave.), Troy, N.Y.

FARMER, WILLIAM BENNETT (Jun. '47) 16617 Fernway Rd., Shaker Heights 20, Ohio.

FAYLOR, JOHN DAYTON (Assoc. M. '48) Div. Engr., Armco Drainage & Metal Products Inc., 444 Insurance Exchange Bldg., Des Moines, Iowa.

FEBESH, MELVIN (Jun. '47) 1881 Stillwell Ave., New York 61, N.Y.

FELLERS, GEORGE OWEN (Jun. '48) Graduate Student Civ. Eng., Johns Hopkins Univ. (Res., 5416 Hilburn Ave.), Baltimore 14, Md.

FLEISHER, DONALD RALPH (Jun. '48) Junior Engr. Designer (Structural), G. Clinton Brookhart, 6th & Maday Sts., (Res., 2628A North Sixth St.), Harrisburg, Pa.

GIFFORD, DANIEL WENZELL (Assoc. M. '48) Civ. Engr., St. Louis Dist. Corps of Engrs., New Federal Bldg., St. Louis, Mo.

FLEMING, LESLIE RAYBURN (Jun. '48) Structural and Concrete Design, Process Engrs., Inc., 2409 Ross Ave. (Res., 4323 Lemmon Ave.), Dallas 4, Tex.

FLEMING, RODNEY RAE (Jun. '48) Rodman, Eng. Dept., Chicago & Northwestern Railway Co., 500 West Madison, Chicago, Ill. (Res., 112 East Wheeler Ave., Mankato, Minn.)

FORBES, F. POWELL (Assoc. M. '48) Mgr., Eng. and Fabrication Div., Weyerhaeuser Timber Co., P.O. Box 629, Newark (Res., Box 385, Madison), N.J.

FOSTER, JOHNSON LEON (M. '48) Chf., Bldgs. and Structures Section, Engr. Office, Headquarters Third Army, Fort McPherson (Res., 570 Peachtree Battle Ave. N.W., Atlanta), Ga.

GAGNON, CLARE JOSEPH (Jun. '48) Asst. Engr., Rowat & Murray, Engrs., Belmond, Iowa.

GAIGHER, RUPERT (Jun. '48) Soil Erosion Engr., Dept. of Agriculture, Box 965, Bloemfontein, South Africa.

GAMALERO, MARIO WILLIAM (Jun. '48) Asst. Constr. Engr., Inst. of Inter-American Affairs, 6A Ave. South 54 (Res., 4A Calle Poniente 21), Guatemala City, C.A.

GARBACIK, LEWIS ADAM (Jun. '48) Junior Engr. R. H. Woelfel, Engr. & Contr., Markle Bank Bldg., Hazelton (Res., 616 West Green St., West Hazelton), Pa.

GARCIA-MONTES, RAFAEL (Jun. '48) Civ. Engr., Ministerio de Obras Publicas, Ave. de Belgica #258, Habana, Cuba.

GERSTENZANG, NORMAN PAUL (Jun. '47) Asst. Civ. Engr. (Structural), Board of Transportation, 250 Hudson St., New York (Res., 35 Linden Blvd., Brooklyn 26), N.Y.

GEVECKER, ROBERT VERNON (Jun. '48) Bridge Detailer, State Highway Dept. (Res., 414 Cherry), Jefferson City, Mo.

GIDLUND, ALETTA WOOD (Miss) (Jun. '47) Junior Civ. Engr., State Div. Highways, P.O. Box 311 (Res., 1015 California St.), Redding, Calif.

TOTAL MEMBERSHIP AS OF JUNE 9, 1948

Members	7,075
Associate Members	9,160
Corporate Members	16,235
Honorary Members	41
Juniors	7,220
Affiliates	74
Fellows	1
Total	23,571
(June 9, 1947	21,838)

GONZALEZ HURTADO, HERNANDO (Jun. '48) Civ Engr., Peter Santa Marie Y Cia Ltd. Mgr. Cali, Calle 14 #4–27, Colombia, S.A. (Res., 1862 Arch St., Berkeley, Calif.)

GOOD, EDWARD SAMUEL, JR. (Jun. '48) Field Engr., Gardner-Denver Co., 76th Ninth Ave., New York, N.Y.

GOODNO, REDMOND STEPHENS (Jun. '48) Eng. Aide (Civ.), Corps of Engrs., Buffalo Dist (Res., 368 East Utica St.), Buffalo 8, N.Y.

GORRILL, WILLIAM ROY (June. '48) Instr. in Civ. Eng., South Apts., Univ. of Maine, Orono, Me.

GOWDA, KALLADEVANAHALLI RAMIAH SURYANARAYANA (Jun. '48) Engr., Mysore Govt., Bangalore, South India. (Res., 202 Graduate College, Princeton, N.J.)

GREEN, RAYMOND FREDERICK (Jun. '48) Civ. Engr., C. F. Braun and Co., P.O. Box 502 (Res., 215 West Jersey St.), Elizabeth, N.J.

GRESHNER, WILLIAM DENTON (Jun. '47) 1112 French St., Santa Ana, Calif.

GREYNALD, BERTRAND WILLIAM (Jun. '47) 119 Hillcrest, Inglewood, Calif.

GREZ, PATRICIO (June. '48) Design and Gen. Engr., Melon Cement Corp., Casilla 161-D, Santiago, Chile.

GROVE, WILLIAM EDGAR, JR. (Jun. '47) Asst. Maintenance Engr., Libbey-Owens-Ford Glass Co., 1701 East Broadway, Toledo (Res., Curtice), Ohio.

GRUNER, EDWARD CHARLES (M. '48) Cons. Engr., Henri E. Gruner & Fils, 7 Nauenstrasse, Basel 2, Switzerland.

GUY, BRISCOE BALDWIN (Jun. '48) Structural Project Insp., Stone & Webster Inc., 1402 Roseneath Rd. (Res., Box 296, R.F.D. 9), Richmond, Va.

HAAG, CHARLES MILTON (Jun. '48) Process Engr., Carnegie-Illinois Steel Corp., Homestead Works, Homestead (Res., 691 Morgantown Rd., Uniontown), Pa.

HAAK, PERE OLOF (Assoc. M. '48) Structural Engr., Charles T. Main, Inc., 80 Federal St., Boston, Mass. (Res., 14 Tufts St., Cambridge 39, Mass.)

HAINES, SAMUEL EARLE, Jr. (Jun. '48) Constr. Insp., Reading Co., Reading Terminal, Philadelphia, Pa.

HARRIS, JOHN STOUT, JR. (Assoc. M. '48) Locating Engr. (Bridge), State Highway Dept., Little Rock (Res., P.O. Box 32, Perry), Ark.

HARTMAN, MORTON (Jun. '48) Architectural Draftsman, Residential Planning Project, Bituminous Coal Research Investigation, Mumford House, Univ. of Illinois, Urbana (Res., 109 West Wine St., Champaign), Ill.

HATCH, GEORGE FREDERICK (Jun. '48) Cadet Engr., Long Island Lighting Co., 250 Old Country Rd., Mineola (Res., 31 Villa Court, Hempstead), N.Y.

HATCHER, DAVID SHERIDAN (Jun. '47) 1725 La Senda Place, South Pasadena, Calif.

HAYMAKER, WILLIAM JACKSON (Jun. '47) Engr., R. P. Farnsworth & Co., Inc., 1515 South Salcedo St., New Orleans (Res., 834 Iris Rd., Baton Rouge), La.

HELFMAN, MILDRED (Miss) (Jun. '48) Junior Engr., Parsons, Brinckerhoff, Hogan & MacDonald, 51 Broadway, New York (Res., 87-84 One Hundred and Sixty-fifth St., Jamaica), N.Y.

HENDRICKSON, JOHN GRIFFITH, JR. (Jun. '48) Asst. Prof. of Civ. Engr., Princeton Univ. (Res., 405-B Butler Ave.), Princeton, N.J.

HENRY, JOHN BANKHEAD (Jun. '48) Instr., Ohio State Univ. (Res., 2895 Indianola Ave., Apt. A), Columbus, Ohio.

HERBST, ROBERT LEE (Jun. '48) Tech. Asst., State Water Dept., 218 Huron, Ann Arbor (Res., 917 Grant, Ypsilanti), Mich.

HESS, WILLIAM JOSEPH (Assoc. M. '48) Asst. Liaison and Appraisal Officer, State Dept. of Finance, Local Allocation Div., 1020 N. St. (Res., 5200 H. St.), Sacramento 16, Calif.

HILL, CLYDE BROOKS (Jun. '48) Constr. Supt., Constr. Co., Cedar St. (Res., 105 Jackson St.), Fulton, Ky.

HNOT, JOSEPH, JR. (Jun. '48) Inspection Engr., Standard Oil Co., Whiting (Res., 7030 Madison Ave., Hammond), Ind.

HOBBS, WILLIAM HUGH (M. '48) Director of Research, Missouri Pacific Lines, 2200 Missouri Pacific Bldg., St. Louis 3, Mo.

HOLAB, SIDNEY HIRSCH (Jun. '48) Supt., Holab Plumbing & Heating Co., 1918 Humboldt Blvd., Chicago 47, Ill.

HOOVER, BLANTON WILLIAM (Jun. '48) Secy. and Treasurer, Hoover Machinery Co., Box 249, Oklahoma City, Okla.

HOVORKA, GEORGE (Assoc. M. '48) Civ. Engr., Univ. of Chicago, 69 West Washington St., Chicago, Ill.

HUBBARD, JOHN HARRISON (Jun. '48) Engr. (Civ.), P-1, Corps of Engrs., U.S. Army, 322 Center St., Olean, N.Y.

HUBER, RAYMOND LEE (M'48) Civ. Engr., Corps of Engrs. Omaha Dist. Office, 1709 Jackson St. Office, 1709 Jackson St. (Res., 4826 Woolworth Ave.), Omaha 6, Nebr.

JANECEK, RUDOLPH JOSEPH (Jun. '48) Field Engr., Lago Oil & Transport Co., Aruba, N.W.I.

JARRETT, DONALD LEE (Jun. '48) Phillips Petroleum Co., Eng. Dept., Bartlesville, Okla.

JENNINGS, THOMAS SHANNON (Jun. '48) Instr., Univ. of South Carolina, Box 189 (Res., 3015 Gervais St.), Columbia, S.C.

JERMAN, DANIEL LEE (Jun. '48) Detailer, Pittsburgh Des Moines Steel Co., Neville Island, Pittsburgh (Res., 601 Nevin Ave., Sewickley), Pa.

JONES, EUGENE FREDERICK (Jun. '48) Engr. Inst. II, Missouri Highway Dept., Box 118, Paris (Res. 920 South Jefferson St., Mexico), Mo.

JONES, WARREN LATTIMER, JR. (Jun. '48) 706 E. St., Rome, N.Y.

KAM, WILLIAM CHAN (Jun. '48) Junior Subway Civ. Engr., Dept. of Subways and Superhighways, North Wacker Drive (Res., 4900 North Sheridan Rd.), Chicago 40, Ill.

KAMENER, LOUIS (M. '48) Civ. Engr., Board of Water Supply, 120 Wall St., New York 5, N.Y.

KANE, HENRY HORACE (Assoc. M. '47) Chf. Engr. with Amsterdam Govt., Care, Dist. Bank, Northendem, Manchester, England.

KENIG, ALBERT (Jun. '48) 106 Chestnut St., Norwich, Conn.

KIENDL, OSCAR GEORGE (Assoc. M. '48) Chf. Structural Engr., Safway Steel Products, Inc., 6228 West State St. (Res., 3829 North 56th St.), Milwaukee 10, Wis.

KOONTZ, MARVIN BELL (Jun. '48) Designing Engr., Draftsman, Rust Eng. Co., Exchange Bldg. (Res. 2521 Lane Park Rd.), Birmingham 9, Ala.

KRONST, ROBERT EDWARD (Jun. '48) Civ. Engr., State Div. of Highways, Dist. 10, 160 North La Salle St. (Res., 2325 West Superior St.), Chicago 12, Ill.

KRUSE, EDWARD HERMAN (Jun. '47) 6243 College Ave., Oakland 11, Calif.

LAMON, LONNIE GRADY (Jun. '47) Civ. Engr., County Surveyor, Alameda County, County Courthouse, Oakland (Res., 1925A Stuart St., Berkeley), Calif.

LANG, GILBERT DEFOREST (Jun. '48) Senior Engr. Draftsman, City of Toledo Eng. Dept. (Res., 516 Mulberry St.), Toledo, Ohio.

LANGFORD, JOSEPH HERBERT (Assoc. M. '48) Gen. Supt., Heavy Constr., Cleary Bros. Constr. Co., P.O. Box 6815, West Palm Beach, Fla.

LAWRENCE, CARL LOWRY (Jun. '48) Research Asst., Univ. of Minnesota, St. Anthony Falls Hydraulic Laboratory, Hennepin Island (Res., 229 Fifth Ave. S.E.), Minneapolis 14, Minn.

LAWRENCE, GERALD RONALD Jun. '48) Engr. U.S. Steel Export Co., 30 Church St. (Res., 330 West 72d St.), New York 23, N.Y.

L'ENGLE, JOHN BRADLEY, JR. (Jun. '48) Estimator, Arthur Perry Inc., P.O. Box 1577 (Res., 2140 Herschel St.), Jacksonville 4, Fla.

LEWIS, ARTHUR ELLISON (Jun. '47) Structural Designer, Seaboard Airline R.R. Co., Seaboard Airline Bldg., Norfolk, Va.

LIBERSHAL, FRANCIS MEISINGER (Assoc. M. '48) Engr. Estimator, Ernest Rokahr & Sons Inc., 2241 "Y" St. (Res., 950 South 36th St.), Lincoln, Nebr.

LI CALZI, LUKE (Jun. '48) Junior Engr., Victor Mayper, Cons. Engr., 110 West 40th St., New York (Res., 2340 Sixty-third St., Brooklyn), N.Y.

LIGGETT, WILLIAM HENRY (M. '48) Instr., Northrop Aeronautical Inst., Hawthorne (Res., 209 Ave. G, Redondo Beach), Calif.

LINDSKOG, EDWARD (Jun. '47) Structural Engr. Asst., Dept. of Bldg. & Safety, City of Los Angeles, City Hall (Res., 594 West Ave. 26), Los Angeles 31, Calif.

(Continued on page 96)

THE PERMUTIT PRECIPITATOR

removes

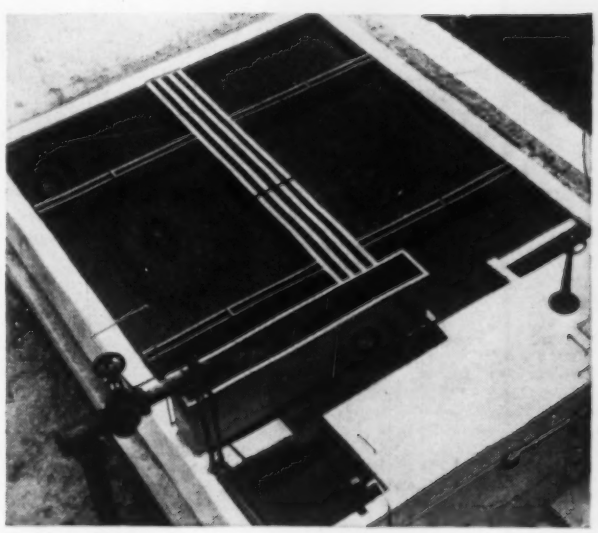
- turbidity
- color
- taste
- odor
- hardness
- alkalinity
- silica
- fluorides

All undesirable impurities are removed from water supplies in less space, less time and at less cost with the Permutit (Spaulding) Precipitator. All savings are substantial! This Precipitator operates on the sludge blanket principle of upward filtration originated and introduced by Permutit.

Check the extremely economical features of the Permutit Precipitator! Better still, call in Permutit engineers for free consultation on your water conditioning problems. Write The Permutit Company, Dept. EN-5, 330 West 42nd Street, New York 18, N. Y., or the Permutit Company of Canada, Ltd., Montreal.

for 35 years
water conditioning
headquarters

Permutit



(*Continued from page 94*)

INSTRUCTOR OR ASSISTANT PROFESSOR in civil engineering, to teach undergraduate courses in highway engineering and in soil mechanics, and to assist in field and laboratory work in civil engineering and hydraulics. Master's degree preferred but not required. Location, Vermont. Y-941(a).

ASSISTANT PROFESSOR in civil engineering, to teach structures and transportation, including work in the mechanics of solids, materials testing laboratory and other basic civil engineering subjects. Salary, $3,940 for 10 months. Position permanent. Location, Connecticut. Y-944.

ENGINEERS. (a) Superintendent of Construction and Maintenance, 25–45, civil, mechanical or electrical engineering graduate preferred, with some practical experience, to supervise engineering problems related to receipt, storage, transportation and bulk and retail sales of all grades of petroleum products. Salary, $4,000–$5,000 a year. (b) Engineers for main office of same company, covering same general field as well as general warehousing field in both petroleum and nonpetroleum merchandise. Location, Midwest. Y-945.

CONSTRUCTION SUPERINTENDENTS AND FIELD ENGINEERS with oil refinery experience for domestic and foreign work. Give complete résumé of experience, training, age, availability and salary expected. Headquarters, Ohio. Y-951-D.

TEACHING PERSONNEL. (a) Associate Professor, M.S. degree in civil engineering, with 5 years college teaching, engineering subjects, and one year academic responsibility and professional responsibility. Salary, $4,500 a year. (b) Assistant Professor, M.S. degree in civil engineering, with two years college teaching, engineering subjects. Salary, $4,000 a year. Location, Michigan. Y-962-D4179.

CONSTRUCTION ENGINEER who has had several years' experience acting as a resident engineer on heavy construction work preferably water works and sewage plants. Location, Pennsylvania. Y-975.

CIVIL ENGINEER, 30–35, preferably single, with at least 3 to 5 years' experience, to estimate and supervise structural steel designing for large building. Salary, $9,000–$12,000 a year. Location, Philippine Islands. Y-1001.

SQUAD LEADER, structural designer, 30–40, to take over the supervision of a structural design group up to 5 men. Must have at least 5 years' experience on building design and any experience on sewerage and water distribution systems desirable. Salary, $7,200 a year. Location, New York, N.Y. Y-1006.

SANITARY ENGINEERS. (a) Sanitary engineer, graduate, with 5 to 15 years' experience in waterworks and/or sewerage, for consulting engineer's office doing business throughout Middlewest. Permanent and fine opportunity. Salary based on ability. Position available immediately. (b) Sanitary engineers, graduates, for consulting engineer's office, with 2 years' experience in waterworks or sewerage. Positions available immediately. Excellent opportunity. Salary based on ability. Location, Michigan. Y-1010.

CIVIL ENGINEER for general contractor's office. Must be highly capable, hard working, executive ability, with thorough experience and proven reliability for company handling construction of industrial, commercial buildings and institutions. Position permanent. Salary open. Location, Pennsylvania. Y-1068.

ENGINEERS. (a) Office engineer, civil graduate, with building and general construction experience to be responsible for job revisions, specifications, etc. Salary, $5,200 a year. (b) Progress engineer, civil graduate, with construction experience, to be responsible for schedules progress reports, etc. Salary, $4,680 a year. Location, upstate New York. Y-1079.

ENGINEERS. (a) Assistant superintendent and job engineer for building construction, 30–45, with extensive field experience in all phases of construction of large fireproof buildings, especially "layout" (lines and grades), checking and coordination of plans, calculation of quantities and supervision of all trades. Salary, $6,500 a year. (b) Assistant building construction superintendent for mechanical and electrical trades, 30–45, with extensive field experience in supervising the installation and coordination of heating, ventilating, air conditioning, plumbing, sprinkler and electrical work on large fireproof commercial buildings. Practical experience as well as knowledge of theory is essential. Salary, $6,500 a year. Location, New York, N.Y. Y-1081.

STRUCTURAL ENGINEER to act as chief draftsman for small drafting room on chemical plant equipment. Usual staff plant position which includes process, power plant, machine layout, etc. Salary, $6,000 a year. Location, Virginia. Y-1089.

ENGINEER, to assist on all municipal engineering, including supervision of laying out and construction of sewers and streets in a city of 15,000. Should be engineering graduate or eligible for Michigan registration. Salary open. Location, Michigan. D-4224.

(*Continued from page 92*)

LOCKWOOD, ROBERT KING (Jun. '48) Junior Engr., Malcolm Pirnie Engrs., 4000 Galatin Ave. (Res., 5203 Thirty-eighth Ave.), Hyattsville, Md.

LOKEY, WILBURN BUFORD (Jun. '48) Civ. Engr. I, Wayne County Road Comm., Barlum Tower (Res., 12045 Promenade), Detroit, Mich.

LOOMIS, JOHN EDWARD (Jun. '48) Asst. Cadastral Engr., Bernice P. Bishop Estate, 848 Kaahumanu St. (Res., 2740 Ferdinand St.), Honolulu, T.H.

LORENZI, SILVIO JOSEPH (Jun. '48) Graduate Student, Carnegie Institute of Technology (Res., Oakton Rd., Brentwood), Pittsburgh 27, Pa.

LUCAS, KENNETH BARRETT (Assoc. M. '48) Field Engr., Portland Cement Assoc., 208 West 4th, North Platte, Nebr.

MAC LEAN, DUART ALAN (Jun. '48) Asst. Hydr. Engr., Water Rights Branch, Parliament Bldgs., Victoria, B.C., Canada.

MATTA-DIAZ, JOSE RAFAEL (Jun. '48) Junior Field Engr., Puerto Rico Water Resources Authority, Southwestern Puerto Rico Project, Yauco (Res., 22 Iglesias St., Mayaguez), Puerto Rico.

MCCLURE, MACK RUSSELL (Jun. '48) Transitman, H. A. Shope, Registered Engr., Homestead (Res., 518 Fawcett St., McKeesport), Pa.

MCGUIRE, ALBERT GAYLE, JR. (Jun. '48) Bridge Designer and Detailer, Wyoming Highway Dept. (Res., 310 East 22d St.), Cheyenne, Wyo.

MCKEE, JAMES CAVANAUGH (Jun. '48) Instrumentman, United Engrs. and Constructors, Inc., 1401 Arch St., Philadelphia, Pa. (Res., 9204 South Blackstone Ave., Chicago 19, Ill.)

MCMINN, JACK HUDSON (Jun. '48) Engr., Standard Oil Co. of Calif., Eng. Dept., 225 Bush St., San Francisco, Calif.

MCWHORTER, WILLIAM WESLEY (Jun. '48) Draftsman, Structural Detailer, American Bridge Co., Gary Plant (Res., 450 Rutledge St.), Gary, Ind.

MICHEL, JOHN FIELD (Assoc. M. '48) Major, U.S. Army, Corps of Engrs., 201 North 30th St. (Res., 712 Chestnut St.), Grand Forks, N.Dak.

MILLER, WILLIAM RUSSELL (Jun. '48) Civ. Engr., J. J. Woltmann-Cons. Engr., 314 Unity Bldg., Bloomington, Ill.

MITCHELL, ROBIE LAWTON (Affiliate '48) (Mitchell & Pershing), 120 Broadway, New York 5, N.Y.

MOREAU, PIERRE JULIEN-ACHILLE (M. '48) Gen. Mgr., Estacas Frank Ltd., Avenida Rio Branco 311, Rio de Janeiro, Brazil, S.A.

MORSE, EVERETT DEAN (Assoc. M. '48) Civ. Engr., Houston Lighting & Power Co., P.O. Box 1700, Houston 1, Tex.

NASH, MELVIN J. (Jun. '48) Engr. Aide, Bridge Dept., State Highway Dept., Olympia (Res., Route 10, Box 866, Tacoma), Wash.

NEWLIN, CHARLES WILLIAM (Jun. '48) Student in Soil Mechanics, Graduate School of Eng., Harvard Univ., Cambridge, Mass. (Res., 926 Barton Ave., Terre Haute, Ind.)

OLSEN, DONAL ALAN (Jun. '48) Architectural Draftsman, Olsen & Urbain Archt. & Engrs., 5 South Wabash Ave., Chicago (Res., 673 Forrest Ave., Glen Ellyn), Ill.

OLSON, ROBERT MERLE (Jun. '48) Eng. Asst., State Highway Dept., P.O. Box 672, Dickinson, Tex.

ORTWERTH, MARVIN JOSEPH (Jun. '48) Graduate Student, Washington Univ. (Res., 3863 Utah Place), St. Louis, Mo.

OSTROM, DONALD DUANE (Jun. '47) Junior Engr., Professional Training Program, Standard Oil Co. of California, Box 97, Avenal, Calif.

OVIATT, GEORGE TREAT (Jun. '48) Engr., Dept. of the Army, Corps of Engrs., Limestone Air Base, Limestone (Res. Care, Mrs. A. Merrithew, R.F.D. 2, Fort Fairfield), Me.

PACE, PANFILO (Jun. '48) Superv. Engr., L. F. Pace & Sons, Gen. Constrs., 100 Taft Ave., Bridgeport, Conn.

PAGE, PHILIP POWERS JR. (Jun. '48) Junior Designer, Seelye, Stevenson & Value, 101 Park Ave., New York 17, N.Y. (Res., 654 Bergen Ave., Jersey City 4, N.J.)

PANCHANATHAN, SWAMINATHA (Jun. '48) 713 Furnald Hall, Columbia University, New York, N.Y.

PAPOULAS, GEORGE (Jun. '48) Tutor, College of the City of New York, 139th St. and Convent Ave. (Res., 102 West 92d St.), New York, N.Y.

PITTMAN, ALFRED STANLEY (Jun. '48) Junior Engr., Pennsylvania R.R., 85 Westmoreland Rd., Trafford, Pa. (Res. 57 Rhinecliff St., Arlington, Mass.)

RAINERY, LOUIS DONALD (Jun. '47) Structural Engr., Edgardo Contini, Civ. Engr., 9360 Santa Monica Blvd., Beverly Hills (Res., 1042 Twenty-third St., Santa Monica), Calif.

RAMASWAMI GURUVAYUR, SUBRAMANYAM (Jun. '48) Graduate Student of Technology, Govt. of India Scholar, Pasadena 4, Calif.

REED, BILLY CHARLES (Jun. '48) Research Asst., Univ. of Illinois, Room 113, Talbot Laboratory, Urbana, Ill.

RICKEY, HORACE BUSHNELL, JR. (Jun. '48) Vice-Pres., (Horace B. Rickey, Inc.), Box 218, Lafayette, La.

RIVERS, JOSEPH LAROCHE (Jun. '48) Instr., Clemson A. & M. College, Box 1222, Clemson, S.C.

ROBINSON, BERNARD LINN (M. '48) Col., Corps of Engrs., U.S.A., 606 Santa Fe Bldg., Galveston, Tex.

ROBOHN, WALTER FREDERICK (Jun. '48) Graduate Asst., Civ. Eng., Kansas State College, Manhattan, Kans.

ROE, OLE S. (M. '48) Chf. Structural Engr., W. J. Knight & Associates Inc., 705 Chestnut St. (Res., 3733 Lindell Blvd.), St. Louis, Mo.

ROFFMAN, IRWIN J. (Jun. '48) Estimator and Contr., S. W. Roffman & Co., 2095 Broadway, New York, N.Y.

ROLLINGS, ROBERT IRVIN (Jun. '48) Rodman, Nickel Plate Rd., 300 North Main St., Frankfort (Res., Reelsville), Ind.

ROSCHE, MELVIN GRADEN (Jun. '48) Aeronautical Research Engr., National Advisory Committee for Aeronautics, Langley Field (Res., 83 D-Eliz Rd., Hampton), Va.

SACHS, LEWIS HARVEY (Jun. '48) Constr. Engr. Frazier Davis Constr. Co., Box 633, Balboa, Canal Zone. (Res., 6160 Waterman Ave., St. Louis, Mo.)

SALLOOM, ALBERT (Jun. '48) Transitman for Constr. Co., C. F. Braun Co., Alhambra, Calif. (Res., 62 Plantation St., Worchester, Mass.)

SCHAACK, CHARLES AUGUSTE (M. '48) 20 Avenue des Terres-Rouges, Esch-Sur-Alzette, Grand Duchy of Luxembourg Germany.

SCHERTZ, DONALD JOHN (Jun. '48) Inspection Engr. Standard Oil of Indiana, Care, Inspection Dept. (Res., 2038 Stanton Ave.), Whiting, Ind.

SHAFER, ROBERT WELDON (Jun. '48) Constr. Engr., L. & M. Constr. Co., 843 Vance Ave., P.O. Box 78 (Res., 1515 South Wellington St.), Memphis, Tenn.

SHAFFER, HAROLD SEAMAN (Jun '48) Graduate Student, Univ. of Illinois (Res., 1109 West Spring Ave.), Urbana, Ill.

SHAIN, CLARENCE BLACKBURN (M. '48) Director of Highways, Transportation Bldg. (Res., Route 3, Box 445), Olympia, Wash.

SHAMSUDDIN, MOHAMMAD (Assoc. M. '48) Civ. Engr., H.E.H. The Nizam's Govt. Hyderabad-Deccan India. (Res., Box 800, Central Y.M.C.A., Brooklyn, N.Y.)

SHARMA, BAIJ NATH (Assoc. M. '47) Constr. Engr., Irrig. Dept., Galawela, Matale, Ceylon.

SHIRK, KEITH EDGAR (Jun. '48) Asst. Engr., Omaha Steel Works, 609 South 48th St., Omaha, Nebr. (Res., 18 West Orchard Ave., Council Bluffs, Iowa.)

SHUMAN, STANLEY (Jun. '48) Asst. Gen Mgr., Shuman Constr. Co., 11 Lorna Rd., Mattapan 26, Mass.

SMITH, ARNOLD REMINGTON (Jun. '48) Asst. Engr., Malcolm Pirnie Engrs., 25 West 43d St., New York (Res., 294 Read Ave., Crestwood), N.Y.

SMITH, GARFIELD EVERETT (Jun. '48) Structural Engr., Cummins & Barnard, 301 State Savings Bank Bldg. (Res., 1809 Hill St.), Ann Arbor, Mich.

SMITH, MARK ANTHONY, JR. (Jun. '48) Supt., Raymond Concrete Pile Co., 140 Cedar St., New York 6, N.Y. (Res., 241 Jackson Springs Rd., Macon, Ga.)

STAUBER, ARTHUR DOUGLAS (Jun '47) 5709 Keith Ave., Oakland, Calif.

STEPHENS, NUBERN ZACK (Assoc. M. '47) Box 904, Curundu, Canal Zone.

STONE, BERNARD FRANCIS (Jun. '48) Asst. Constr. Supt., Arthur Whitcomb Inc. (Res., 19 Victoria St.), Keene, N.H.

STRIKE, CLIFFORD STEWART (M '48) Pres., F. H. McGraw & Co., 780 Windsor St., Hartford, Conn.

SULLIVAN, BERNARD JOHN (M. '48) Div. Engr., Board of Water Supply, P.O. Box 146, Downsville, N.Y.

TESSIER, LARRY ORPHER, JR. (Jun. '48) Inspection Engr., Standard Oil Co., Whiting (Res., 368 Marshall St., Gary), Ind.

THOMAS, ARTHUR HENRY (Jun. '48) Draftsman Surv., Arkansas Map Co., 209½ West 2d St., Little Rock, Ark.

HELIOS new, better BLACK line prints

RY DEVELOPED

● Here are positive line working prints that are amazingly clear and easy to read. Every detail on the original pencil drawing is reproduced in crisp, dense black lines that stand out in sharp contrast against the white background.

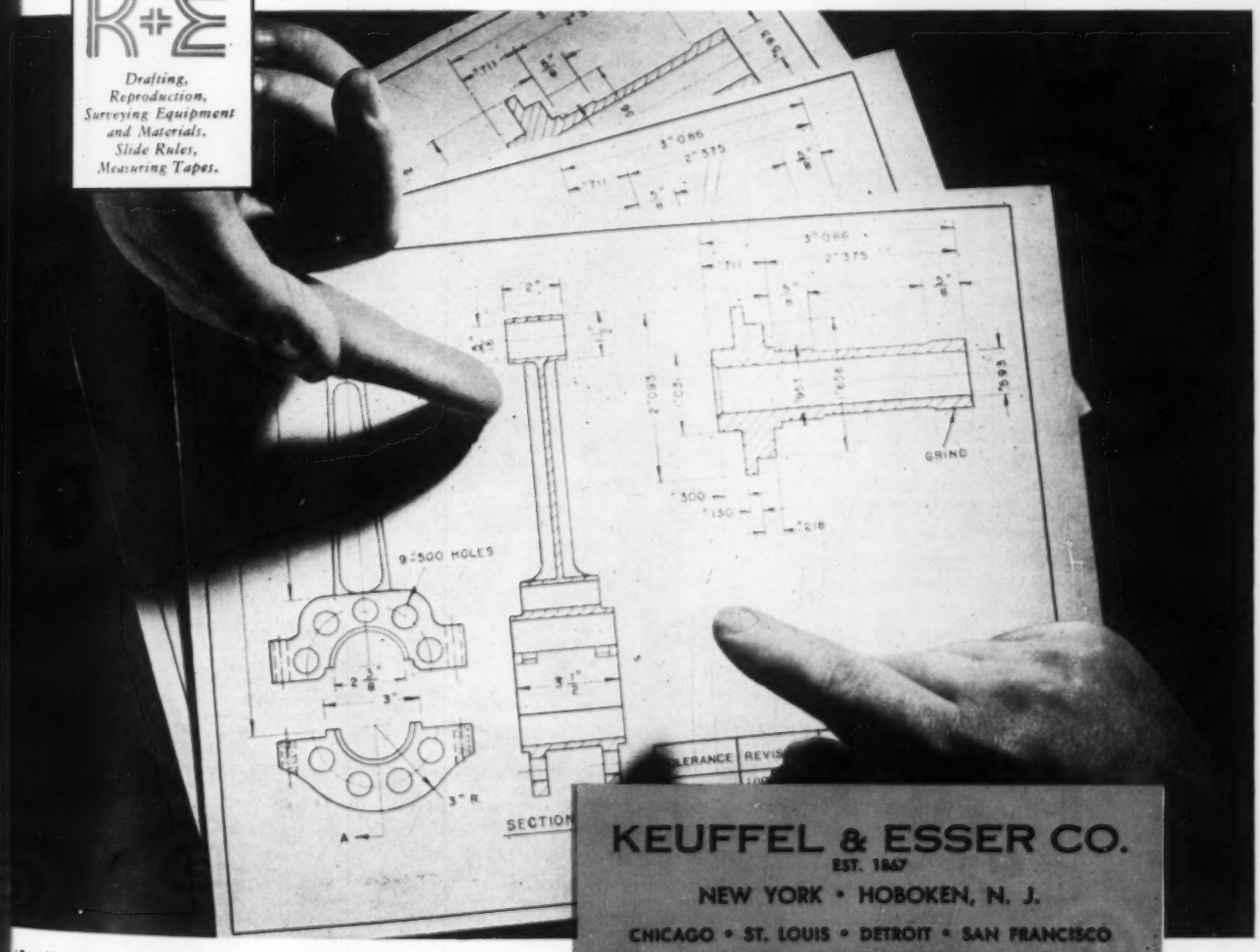
It has been the goal of K&E in developing Helios†, to bring you a better, more dependable line of dry diazo reproduction materials than had ever been made before. To achieve this, K&E established a new, modern plant for the manufacture of Helios materials exclusively. We not only make the finished products—but we manufacture, to our own exacting standards, the required color-forming components. You see the results whenever you make prints on Helios papers, cloths or films—for their consistently high quality is due to the fact that, from start to finish, Helios materials are made with the skill, care and vigilance characteristic of K&E throughout 81 years of making drafting and reproduction materials and equipment.

partners in creating

You can make positive line working prints on black line, blue line or maroon line opaque Helios papers or cloth *directly* from original drawings, layouts, letters, documents, forms. Or you can save your originals and reproduce positive line working prints *directly* from positive line intermediate originals on Helios transparent papers, cloth or films. For samples, write Keuffel & Esser Co., Hoboken, N. J., or ask your K&E Dealer or K&E Branch for a demonstration. Remember . . . you're *positive* with Helios!

K+E

Drafting, Reproduction, Surveying Equipment and Materials, Slide Rules, Measuring Tapes.



KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
CHICAGO • ST. LOUIS • DETROIT • SAN FRANCISCO
LOS ANGELES • MONTREAL

†Reg. U. S. Pat. Off.

THOMPSON, FRANK LESLIE (M. '48) Civ. Engr., Board of Water Supply, 120 Wall St., New York 5, N.Y.

THOMPSON, MYRON OTIS (Jun. '48) Structural Engr., Worden-Allen Co., 4100 North 3d St. (Res. 3100 West Lisbon Ave.), Milwaukee 8, Wis.

TICK, DANIEL JAY (Jun. '48) Examiner of Patents, U.S. Patent Office, Dept. of Comm. Bldg. (Res.; 6101 Fourteenth St. N.W.), Washington, D.C.

TIMME, ALEXANDER (Jun. '48) Job Engr., United Engrs. & Constrs. Inc., 1401 Arch St., Philadelphia (Res., 28 West Guernsey Ave., Abington), Pa.

TURPIN, OWEN WHARTON (Assoc. M. '48) (Hall, Turpin and Wachter), 803 Cathedral St. (Res., 3923 Norfolk Ave.), Baltimore, Md.

UHL, ROBERT HART (Jun. '48) (Uhl Constr. Co.), Box 509, Bowling Green, Ky.

VAN SANT, JAMES DAVID (Jun. '48) Materials Engr., U.S. Army Engrs., Republican City, Nebr.

WALDVOGEL, JOSEPH LAWRENCE (Jun. '48) Designer-Draftsman, Allied Process Engrs., 86 Trinity Place (Res., 416 East 156th St.), New York 55, N.Y.

WALLACE, GEORGE CURTIS (M. '48) Engr. Div. of Sewers, City and County of Honolulu, Honolulu, T.H.

WARNICK, CALVIN CROPPER (Jun. '48) Asst. Prof. of Civ. Eng., Univ. of Idaho, Dept. of Civ. Eng., Moscow, Idaho.

WATKINS, JOHN FRANCIS (Jun. '47) Earle M. Jorgensen Co., 10650 South Alameda St., Los Angeles (Res., 1105 Parkview Ave., Pasadena 2), Calif.

WEATHERBY, LEE METHVIN (Jun. '48) Acting Senior Party Chf., State Highway Dept. (Res., 605 South Plum St.), Pecos, Tex.

WEBB, JOSEPH BAXTER (Jun. '48) Design Engr., Kimberly-Clark Corp. (Res., 726 Higgins Ave.), Neenah, Wis.

WEIL, NICHOLAS ANDREW (Jun. '48) 117 Talbot Laboratory, Urbana, Ill.

WHIDDEN, FRANCIS EUGENE (Jun. '48) Structural Engr., Libbey-Ownes-Ford Glass Co., 1701 East Broadway (Res., 2045½ Ashland Ave.), Toledo 2, Ohio.

WILLIAMS, CLINTON EARL (M. '48) Asst. Prof., Eng. Dept., Mohawk College, Utica 5, N.Y.

WILSON, MERLE EVERETT (Assoc. M. '48) Analyst, Public Works Div., County of Los Angeles, 502 Hall of Records, Los Angeles, Calif.

WOODS, GILBERT WELCH (Jun. '48) Asst. Designer, Highway Dept., Capitol Office Bldg. (Res., 1107½ N.W. 42d), Oklahoma City, Okla.

WYLIE, RALPH CLARENCE (Jun. '48) Supt., H. F. Allison Co., 7110 Junius (Res., 731 North Ewing St.), Dallas, Tex.

YOGI, MALLACHERUVU VENKATESWARA (Assoc. M. '48) Civ. Engr., Military Engr. Services, Chf. Engrs. Office, Poona, Gip (Res., Vellatur Repalli Taluk, Guntur Dist., Madras), India.

YOUNG, WILLIAM THOMAS (Jun. '48) Safety Engr., Dickerson Inc., (Res., 900 West Franklin St.), Monroe, N.C.

ZANE, ALBERT CHONG-FOOK (Jun. '47) 5415 Madison Ave., Apt. 2D, Richmond, Calif.

Membership Transfers

ASHBAUGH, LEWIS EUGENE, JR. (Jun. '39; Assoc. M. '48) Highway Engr., Public Roads Administration, 211 New Customs House, Denver 2, Colo.

BALBIANI, ANDREW STEPHEN (Jun. '34; Assoc. M. '48) Project Engr., Knappen-Tippetts-Abbett Eng. Co., 280 Madison Ave. (Res., 2078 Morris Ave., Apt. 5B), New York 53, N.Y.

BARRON, REGINALD ARNOLD (Jun. '43; Assoc. M. '48) Eng., Special Study Section, Embankment and Foundation Branch, Soils Div., U.S. Waterways Experiment Station, Vicksburg, Miss.

BEARD, ARTHUR HORNELL, JR. (Jun. '40; Assoc. M. '48) Asst. Engr., Charles H. Hurd, Cons. Engr., 333 North Pennsylvania (Res., 945 North Campbell Ave.), Indianapolis, Ind.

BEETS, FRANK ARNOLD (Jun. '42; Assoc. M. '48) Res. Engr. (Liberty Bend Bridge), Sverdrup & Parcel, Inc., Box #76, Courtney (Res., 11205 East 40th St., R.R. 9, Kansas City 3), Mo.

BRODRICK, GORDON HORTH (Jun. '38; Assoc. M. '48) Owner, (G. H. Brodrick—Civ. Engr.), Box 453, Lander, Wyo.

CHEW, RUSSELL WAGNER (Jun. '26; Assoc. M. '28; M. '48) Engr., Rankin Works, Bethlehem Steel Co., Braddock (Res., 10 Holland Rd., Churchill, Pittsburgh), Pa.

COLLIER, WILLIAM PRESCOTT (Jun. '35; Assoc. M. '48) Field Engr., Gen. Eng. Co., Inc., 725 Central Bldg. (Res., 2568 East 82d St.), Seattle 5, Wash.

COLLINS, JOHN GRIFFIN (Jun. '37; Assoc. M. '48) Topographic Engr. P-3 U.S. Geological Survey, Box 346 (Res., 2248 Marconi Ave.), Sacramento 15, Calif.

COWAN, ROBERT MERTON (Jun. '36; Assoc. M. '48) Civ. Engr., Corps of Engrs., Dept. of Army, 1217 P.O. Bldg., St. Paul 1, Minn.

DODGE, ALEXANDER (Jun. '28) Assoc. M. '44; M. '48) Senior Engr., U.S. Engrs., 628 Pittock Block, Portland, Ore.

DORFMAN, JOSEPH SAMUEL (Jun. '41; Assoc. M. '48) Associate Structural Engr., Dept. of Water & Power, Room 810, 405 South Hill St. (Res., 1329 Keniston Ave.), Los Angeles, Calif.

ESCH, JAMES GEORGE (Assoc. M. '13; M. '48) Pres., Esch Constr. Co., 812 Huron Rd., Cleveland 15, Ohio.

FAIIA, SALVATORE ANTHONY (Jun. '37; Assoc. M. '48) Civ. Engr., American Brass Co., 414 Meadow St. (Res., 86 Fairfield Ave.), Waterbury, Conn.

FITZGERALD, JOHN PAUL (Assoc. M. '40; M. '48) (John P. Fitzgerald, Civ. Engrs.), R.D. 1, Rhinebeck, N.Y.

FLUHR, THOMAS WARREN (Assoc. M. '37; M. '48) Senior Geologist, Board of Water Supply, Downsville, N.Y.

FREGOSI, ALBERT (Jun. '30; Assoc. M. '41; M. '48) Col., Chf. Procurement Office, United States Eighth Army, Headquarters, Eighth Army, Procurement Section, A.P.O. 343, Care, Postmaster, San Francisco, Calif.

FREUND, MAX FREDERICK (Assoc. M. '29; M. '48) Dept. Engr., Board of Water Supply, Church and Warren Sts., Ellenville (Res., Neversink, Sullivan County), N.Y.

HALL, WILLIAM NORMAN (Assoc. M. '15, M. '48) Surveyor and Civ. Engr., 2030 Sixteenth St. North, Arlington, Va.

HANCOCK, J. D. (Jun. '41; Assoc. M. '48) Airport Engr., Civ. Aero Administration, P.O. Box 1397, Little Rock, Ark.

HARDY, ABBY WOLVERTON (Assoc. M. '30; M. '48) Aerial Photogrammetric Engr., Arkansas State Highway Dept., Little Rock (Res., 303 North Washington, Magnolia), Ark.

HIGGS, JAMES ALLAN, JR. (Assoc. M. '19; M. '48) Southeastern Dist. Mgr., Massey Concrete Products Co., 1609 Candler Bldg., Atlanta 3, Ga.

HILLIARD, ARTHUR EUGENE (Jun. '23; Assoc. M. '28; M. '48) Senior Section Engr., Board of Water Supply, Neversink (Res., 4 Burlison Ave., Ellenville), N.Y.

HOAR, VICTOR MYERS (Assoc. M. '40; M. '48) Civ. Engr., Naval Supply Annex (Res., 684 South Central Ave.), Stockton, Calif.

HORTON, HAROLD BURRIS (Jun. '42; Assoc. M. '48) Structural Engr., Wyatt C. Hedrick, Archt.-Engr., 5201 Fannin St. (Res., 4739 Marietta Lane), Houston 4, Tex.

HOWLAND, JAMES CHASE (Jun. '38; Assoc. M. '48) (Cornell, Howland, Hayes & Merryfield), 212 Rennie Bldg., Corvallis, Ore.

HUGHES, CHARLES EDOUARD, JR. (Jun. '35; Assoc. M. '48) Design Engr., Warren & Van Praag, Standard Office Bldg. (Res., 1146 South 21st St.), Decatur, Ill.

IPPEN, ARTHUR THOMAS (Jun. '35; Assoc. M. '40; M. '48) Prof. of Hydr., Massachusetts Inst. of Technology, Cambridge 39, Mass.

LARUE, ROBERTA (Miss) (Jun. '45; Assoc. M. '48) Engr., (Hydr.) P-2, Dept. of the Army, Corps of Engrs., 751 South Figueroa St., Los Angeles (Res., 1628 Walworth Ave., Pasadena 6), Calif.

LAWRENCE, ELWOOD ARTHUR (Jun. '39; Assoc. M. '48) Engr., B. D. Phelps, 435 Union Bldg., San Diego (Res., 584 Mankato Drive, Chula Vista), Calif.

MENDEZ, RAFAEL MARTIN, JR. (Jun. '38; Assoc. M. '48) Engr., O'Kelly & Mendez, Archts. and Engrs., P.O. Box 3586, San Juan, Puerto Rico.

MILLER, WILLIAM ELLSWORTH (Jun. '42; Assoc. M. '48) Asst. to Wm. L. Miller, Engr., and Land Surveyor, Box 63, Wading River, L.I., N.Y.

NASVIK, PETER OLIVER (Jun. '38; Assoc. M. '48) Estimator, Secrest Constr. Co., 1909 Whittier Blvd., Whittier (Res., 316 Crane Blvd., Los Angeles 31), Calif.

NEIL, PATRIC WILSON (Jun. '34; Assoc. M. '48) Dist. Engr., Soil Conservation Service (Res., P.O. Box 1163), Plainview, Tex.

PHELAN, PAUL FREDERICK (Jun. '34; Assoc. M. '48) Highway Engr., Koppers Co. Inc., P.O. Box 7372, Oakland Station, Pittsburgh (Res., Wallace Rd., R.D. 1, Allison Park), Pa.

PROKOPP, EDWARD JOSEPH (Jun. '38; Assoc. M. '48) Chf. Engr., J. L. Peters Co., Beech Rd., Detroit (Res., 726 North Rosevere Ave., Dearborn), Mich.

ROSE, HOWARD DEWITT (Jun. '30; Assoc. M. '40; M. '48) Civ. Engr., Board of Water Supply, Downsville, N.Y.

SAMARZICH, WARREN NICHOLAS (Jun. '39; Assoc. M. '48) Associate Bridge Engr., State Bridge Dept., Box 1499, Sacramento (Res., 24 Landers St., San Francisco 14), Calif.

SHAHAN, EVERETT TERRY (Jun. '37; Assoc. M. '48) Dist. Civ. Engr., Humble Oil & Refining Co., Box 100, Grand Isle, La.

SHERMAN, LESLIE KIMBER (Assoc. M. '37; M. '48) Senior San. Engr., State Dept. of Health, 165 Capitol Ave., Hartford (Res., 87 Wells Drive, Newington), Conn.

STEENHILL, NIELS KOLD (Jun. '40; Assoc. M. '48) Constr. Supt., The Rust Eng. Co., Box 479, Waterville, Me.

UITTI, GEORGE ISAAC (Jun. '28; Assoc. M. '31; M. '48) Architectural Engr., Chicago Board of Education, 228 North La Salle St. (Res., 5530 Neenah Ave.), Chicago 31, Ill.

WEISS, BURRAGE A. (Assoc. M. '41; M. '48) Executive Supt., Imperial Irrig. Dist., Imp. (Res., 551 Sandalwood Drive, El Centro), C

Reinstatements

BRENNAN-CRADDOCK, ALGERNON CHARLES, A. M., Bansha Castle, Bansha Co., Tipperary, reinstated January 1, 1948.

BURROWES, AUBREY SAMUEL, Assoc. M., C. graphic Engr., U.S. Public Health Service, Volunteer Bldg., Atlanta 3, Ga., reinstated 14, 1948

CURTISS, GREY WILLIS, Assoc. M., Dist. E. N.Y., N.H., & H. R.R. Co., 71 Meadow St., Haven (Res., 434 Main St., West Haven), C. reinstated May 14, 1948.

FELLHEIMER, ALFRED M., (Alfred Fellh. Steward, Wagner), 155 East 42d St., New 17, N.Y., reinstated May 13, 1948.

GRAY, BERNARD ELBERT, M., Gen. Mgr., Engr., The Asphalt Institute, 801 Second New York, N.Y., reinstated June 1, 1948.

GRIFFITH, JAMES RINALDO, M., Dean, Sch. Eng., Univ. of Portland, Portland 3, Ore., stated May 13, 1948.

HAMILTON, ANDREW CLAUDE, JR., Assoc. M., C. Engr., (A. C. Hamilton Jr.), 3014 Highland Village, Dallas, Tex., reinstated June 1, 19

JACOBI, ALFRED F., M., Engr., Corps of E. Foot of Prytania St., New Orleans, La., reinst. May 14, 1948.

SABATO, CICCIO, Assoc. M., Civ. Engr., Fus. Marina, (Cosenza), Italy, reinstated Ma. 1948.

SHIRAISHI, TASHIRO, M., Pres., Shiraishi Fou. tion Co., 426 Marunouchi Bldg., Tokyo, J. reinstated May 28, 1948.

TRACK, FRANK ANTHONY, M. Cons. Engr., Pa. Electric Machinery Co., P.O. Box 184, A. C.Z. (Res., 242 East 19th St., New York 3, N. readmitted May 4, 1948.

Resignations

BEADLE, HERBERT J., Assoc. M., 2210 Nueces Austin, Tex., resigned May 18, 1948.

CASE, PAUL DE FORREST, Affiliate, 140 Cedar Room 1308, New York 6, N.Y., resigned M. 1948.

DE LA CANTERA, FERNANDO, M., Care, W. Frick & Kruse, Manila Engr. Dist., Army Office 900, Care, Postmaster, San Franc. Calif., resigned May 21, 1948.

DENN, MARTIN MICHAEL, Jun., 116 Thirty-. St., Manhattan Beach, Calif., resigned Ma. 1948.

FICKES, EUGENE WELDON, Assoc. M., 106 . Ave., Lancaster, Pa., resigned May 6,

GEFFEL, JOHN CHARLES, Jun., Quarters 95, F. E. Warren, Wyo., resigned May 20, 1948.

GITRE, JERRY LEO, Jun., 17415 Birchcrest D. Detroit 21, Mich., resigned May 11, 1948.

HOPSON, WILLIAM HALL., Assoc. M., 17 Hedg. Court, Hempstead, N.Y., resigned May 25,

JOHNSON, MAYNARD DOUGLAS, Jun., Major, U. R. 1, Box 159, South Bend, Ind., resigned M. 1948.

LARSON, ARTHUR HELMAR, Jun., 811 Crotona . North, New York 60, N.Y., resigned May 1948.

PEIRSON, HENRY CONWELL, Assoc. M., 321 So. Parish Pl., Burbank, Calif., resigned May 1948.

PEPER, ROBERT KENNETH, Jun., Hibbing, M. resigned May 25, 1948.

PHELAN, VINCENT BALDWIN, Assoc. M., R.D. Falls Church, Va., resigned May 11, 1948.

POOL, WILLIAM HARRISON, Jun., 9314 Ninty-se. Ave., Woodhaven 21, N.Y., resigned May 1948.

QUICK, PHILLIP RUSSELL, Assoc. M., Box K. Kentfield, Calif., resigned May 19, 1948.

REES, THOMAS FRANK, Jun. 1300½ Spring Quincy, Ill., resigned May 11, 1948.

RICKEY, LEROY EDWARD, Jun., 108 East 33rd Vancouver, Wash. resigned May 20, 1948.

SHERROD, ARCHIE JOSEPH, Jun., 803 East 44th Austin, Tex., resigned May 6, 1948.

SIEG, JACK GEORGE, Jun., 114 East Edwards Springfield, Ill., resigned May 12, 1948.

SIMMS, ALFRED ASTON, Assoc. M., 127 Hope Liguanea P.O., Jamaica, B.W.I., resigned 20, 1948.

SZYMANSKI, STANISLAUS JOSEPH, Jun., Sanders Porter, Cons. Engrs., 42 Broadway, New Yo N.Y., resigned Apr. 30, 1948.

UPTON, WILLIAM BAYLY, JR., Assoc. M., Biological Survey, F.W.A. Bldg., Washing D.C., resigned May 20, 1948.

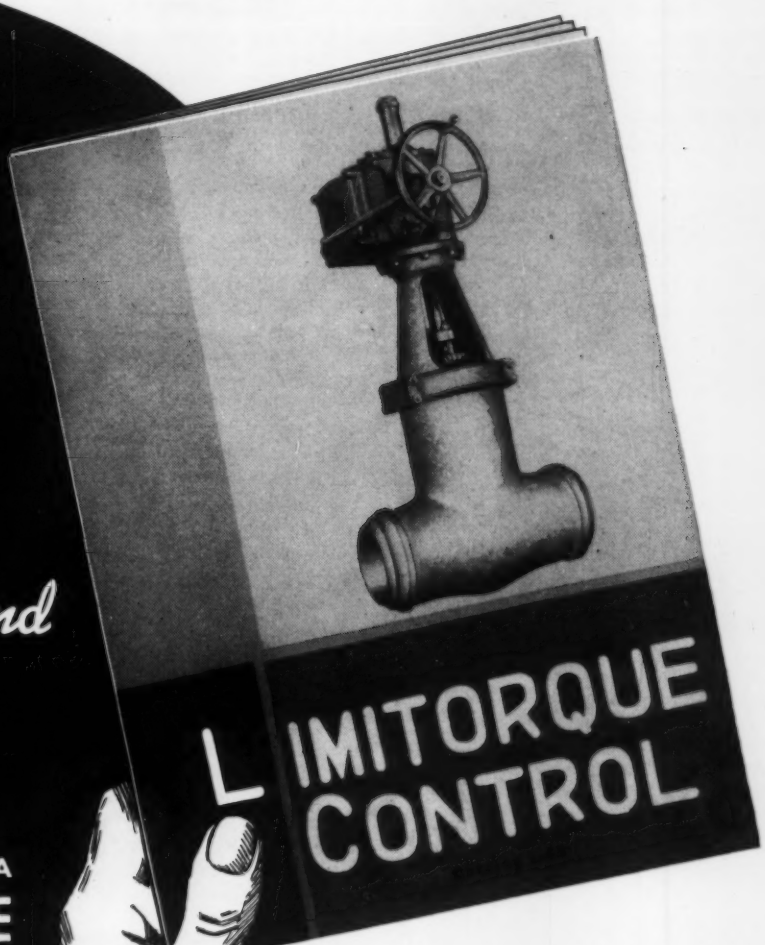
VISCOVICH, STEVEN JOSEPH, Jun., 489 South R. bury Drive, Beverly Hills, Calif., resigned 20, 1948.

for Engineers Interested in Valves and Piping . . . Steam, Water, Oil, Gas, etc.

Here's the Book you've been waiting for:

96 Pages
of Illustrated, Diagrammatic and Tabular Matter regarding . .

PHILADELPHIA
LIMITORQUE
VALVE CONTROLS



Hundreds upon hundreds of valves on land and sea — for every conceivable use, are being safely, speedily and dependably opened and closed by *LimiTorques* day in and day out.

Yes, this catalog shows different types; how they work; how they are connected; wiring diagrams; control panels; floor stands; position indicators; pictures of *LimiTorques* in action in all types of plants; views of *LimiTorques* applied to most all makes of valves, etc.— indeed, a veritable "treatise" on Motorized Valve Operation.

Please be sure to use your *business letterhead* when writing for this valuable catalog.

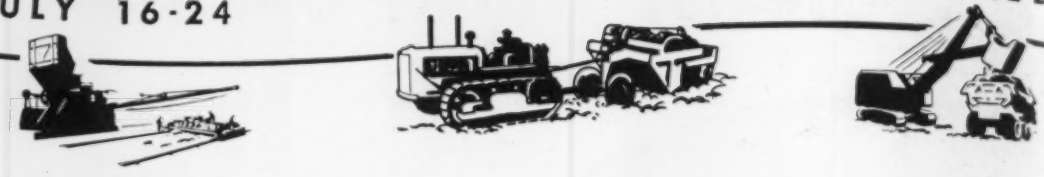
Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

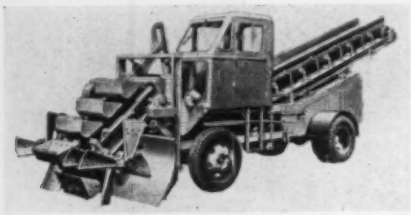
ARBA ROAD SHOW Previews

JULY 16-24 CHICAGO, ILL.



Pettibone Mulliken and Haiss Equipment

JOINT EXHIBITS will be presented by the Pettibone Mulliken Corp. in Booth 2618-A and the George Haiss Mfg. Co. in Booth 2618. Equipment to be displayed will include the Haiss portable trough conveyor belt-type under car unloader, and model



Pettibone Mulliken Speedloader

80W wheel-mounted bucket loader, and the Pettibone Mulliken speedloader, portable batch asphalt plant, clamshell bucket dipper, pullshovel dipper, dragline bucket, and portable gasoline hammer. **Pettibone Mulliken Corp., Chicago, Ill. George Haiss Mfg. Co., Inc., New York, N. Y.**

Warner & Swasey Gradall

PRECISION MANEUVERING of the Gradall, multi-purpose earthmover manufactured by The Warner & Swasey Co., will be featured at Booth 3821. The all-hydraulic Gradall design is particularly useful in ditching, contouring, and sloping to precise dimensions, eliminating slow and expensive hand labor which would otherwise be required. The machine also doubles as a light mobile crane, and speeds jobs by handling concrete forms, pipe and supplies between earth-moving assignments. Truck-mounted, the Gradall can be moved from job to job at highway speed. On-the-job motion pictures will also be shown of some of the 115 machines now in service. **The Warner & Swasey Co., Cleveland, Ohio.**

D-A Lubricant Exhibit

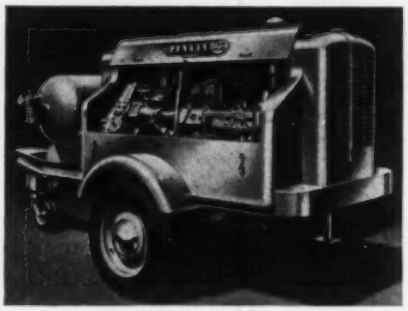
A COMPLETE LINE of lubricants and engine oils used in all types of heavy-duty equipment will be exhibited in booth 1035. **D. A. Lubricant Co., Inc., Indianapolis, Ind.**

Gunnison's Trailer-Type Water Tank

POWER PRESSURE under complete control of the operator has been designed by Gunnison for a new trailer-type water tank which can be towed by tractor or truck. Gunnison will furnish a truck-mounted water tank for the Soil Cement Plane Parking area project which will take place at the Road Show. This unit will supply water direct to the P&H Single Pass Stabilizer and will also handle the necessary moisture application during the compacting and finishing, as well as the curing stages. **Harnischfeger Corp., Milwaukee 14, Wis.**

Jaeger Air Compressors and Paving Machines

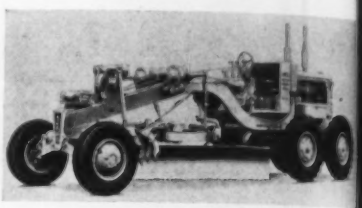
HIGHSPOT of the Jaeger Machine Co.'s exhibit will be its demonstration of a complete line of "New Standard" sizes of portable air compressors in 75, 125, 185, 250, 365 and 600 cfm capacities. These air-plus compressors, featuring 15 to 20 percent increases in rated capacities over previous models and designed to match the air requirements of modern tools, offer 30 to 40 percent greater daily production through full pressure air to tools. The exhibit will also include an extensive display of paving machines including the new type "X" diagonal-screed concrete finisher, the new model BP-5 bituminous paver, the re-mixing, compacting, concrete spreaders and side-discharge truck pavers. Latest model two-speed, hydraulically controlled hoists, dewatering and pressure pumps, building mixers and truck mixers will also be demonstrated. **Jaeger Machine Co., Columbus 16, Ohio.**



125 Compressor

Adams Equipment

HEADLINING THE ADAMS DISPLAY will be the recently introduced No. 610 motor grader which is powered by a 100-hp International diesel engine and has a minimum weight of over 25,000 lb without accessories. With over 18,000 lb on the rear wheels, ample traction is provided to



No. 610 Motor Grader

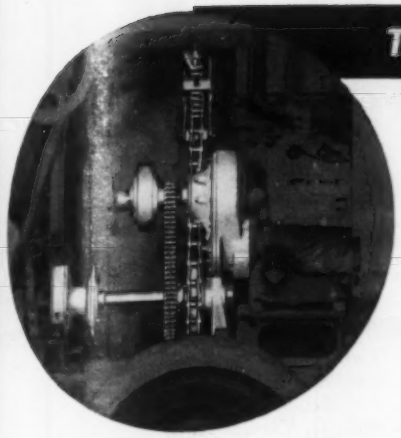
make full use of the powerful UD-18 engine. Also on display will be the 76-hp models, Nos. 512 and 414, the 50-hp model No. 312 and the 31-hp model No. 201. For the first time, the new Adams rotary snow plow-motor grader combination will also be exhibited. Actual operating demonstrations of motor graders will be given at intervals each day of the show. **J. D. Adams Mfg. Co., Indianapolis, Ind.**

Kwik-Mix Equipment

TWO NEW TOOLS to be added to the complete line of cement, bituminous and plaster-mortar mixers, which will be displayed in the Kwik-Mix section of the Koehring products booth, are a power wheel-barrow and a new type, non-tilting 3½-S Dandie cement mixer. The wheelbarrow has differential on the front axle, all anti-friction bearing mounted, travels under power forward and reverse, and has speeds from 2 to 6 mph. All gears and clutch run in oil. **Kwik-Mix Co., Port Washington, Wis.**

Esco Equipment

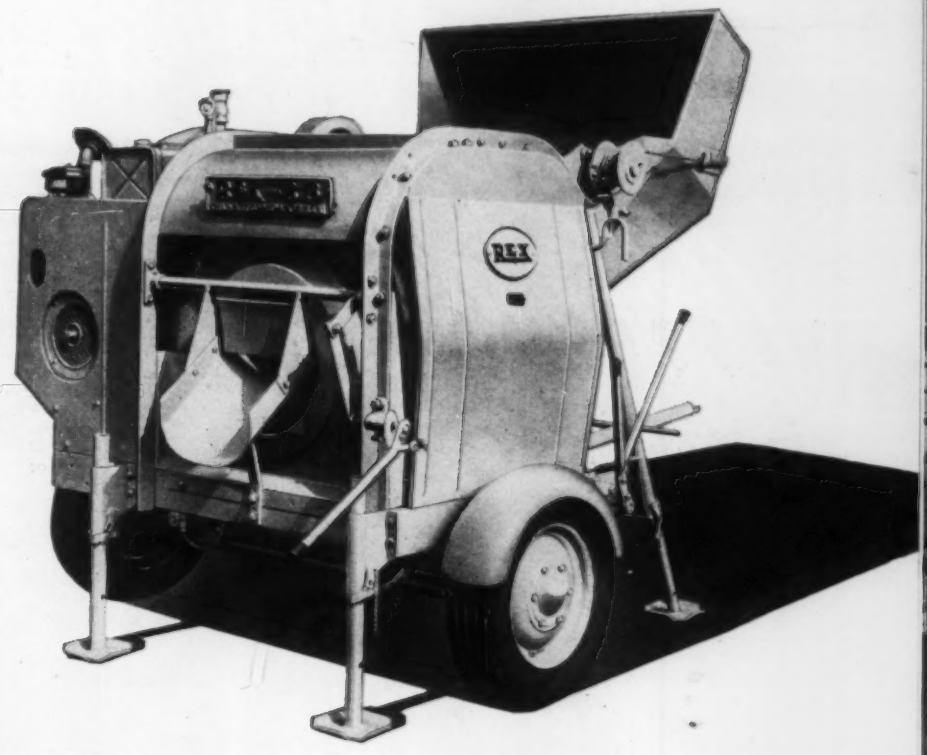
FEATURING BOTH dragline buckets and power shovel dippers as well as parts and other related equipment, the Electric Steel Foundry Co. will exhibit in space 3844. Special emphasis will be placed on the application of ESCO equipment to the coal stripping industry. **Electric Steel Foundry Co., Portland, Ore.**



THE CHAIN TAKES THE STRAIN

The exclusive Rex Chain Drum Drive eliminates stresses and strains. The chain protects the transmission . . . gears . . . shafting . . . power plant. It eliminates binding between drum and transmission during the mixing action. And since the chain transmits power in the "up" direction, the load on the drum rollers is materially reduced.

the Mixers that give you MOST!



Lower Maintenance and Operating Cost

The Rex Chain Drum Drive permits weight to be properly distributed throughout the mixer for extra long life. It eliminates the need for bulky, excessively heavy transmission cases, shafting, bearings, etc. The weight saved here permits us to build added wearing life into parts where it is needed most . . . blades, drum rollers, drum shell and drum supports without sacrificing extreme portability. A Rex Mixer just has to deliver the lowest operating and maintenance costs of any mixer.

The REX "Easy Arc" Controls

Rex Mixers are designed to turn out *more* batches per day with far less manual effort. Operator can handle all controls from one spot. All have ample leverage . . . swing through short, easy arcs for safe, convenient, easy operation. For example, the discharge chute . . . it's outside the drum while mixing, and the operator just gives the lever an easy push that swings the chute into the drum. He doesn't have to lift a chute-full of concrete as is the case on the ordinary chute that's inside the drum during mixing.

There are a lot of other important "Plus" advantages of Rex Mixers. For all the facts, see your Rex Distributor, or write for your copy of Bulletin No. 47-10. Chain Belt Company, 1688 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT

REX

COMPANY

CONSTRUCTION MACHINERY

Koppers Products

A SPECIALLY BUILT display in booth 1015 will show many of the Koppers Co. products and their applications. Among products to be exhibited are Tarmac road material, coatings for concrete abutments and culverts, waterproofing and dampproofing materials, and pressure-treated highway posts and highway bridge materials. Special information on the Company's new prefabricated highway trestle bridges also will be given. **Koppers Co., Inc., Pittsburgh 19, Pa.**

Murphy Power Units

PROMINENT IN THE EXHIBIT of the Murphy Diesel Co., space 1019, will be a typical diesel power unit and a generator set. Cut-away models to be displayed will show such design features as the unit fuel injector, dual overhead camshafts, four valves per cylinder, hydraulic servo-type governor and oil-cooled pistons. A panel of photographs of typical jobs in which Murphy diesel's are used will also be shown. **Murphy Diesel Co., Milwaukee, Wis.**

Caterpillar Equipment

AN ARRAY OF Caterpillar diesel track-type tractors to be exhibited will be headed by the new D8, featuring constant mesh transmission and 130 drawbar horsepower. It will include the other improved machines of the line, the D7, D6, D4 tractors equipped with the full line of earth-moving accessories, cable-controlled and hydraulic-controlled straight blade and angling type bulldozers, scrapers, rippers, cable control unit, and implement hitch. Also to be displayed will be the DW10 wheel-type tractor and W10 wagon, and the combination of the DW10 and the No. 10 scraper. All of the Caterpillar diesel engines, as applicable to road construction and operations, will also be shown—industrial engines, electric sets and marine engines. Supplementing the array of packaged equipment will be all allied equipment with which the company's machines are identified. **Caterpillar Tractor Co., Peoria 8, Ill.**

Altimeters
for all preliminary surveys
How much money will this instrument save YOU? Preliminary surveys in 1/10th the time with accuracy better than 1 part in 1000.
Type SA-1: Range 4360' (-760' to + 3,600') in intervals of 2'
Type SA-2: Range 10600' (-900' to + 9,700') in intervals of 5'
Type SA-5: Range 15000' (-500' to + 14,500') in intervals of 10'
All models priced $200 complete with case, hand & shoulder straps, magnifier and thermometer. IMMEDIATE DELIVERY —see your dealer or write direct for descriptive folder.
AMERICAN PAULIN SYSTEM
Manufacturers of Precision Instruments
1847 SOUTH FLOWER STREET, LOS ANGELES 15, CALIFORNIA
Altimeters

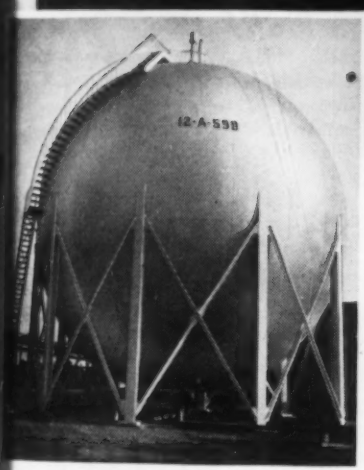
Thor Products

THREE NEW PNEUMATIC CONTRACTORS TOOLS will be exhibited by Independent Pneumatic Tool Co. The newest addition to the Thor line will be the wagon drill. New features and details of design of this machine will not be announced prior to its showing. The second product to be shown for the first time will be the 75-lb paving breaker, companion tool to the Thor 59 and 84-lb breakers. The Backfill tamper will round out the trio of new products to be displayed in addition to the complete Thor line which will include sinker rock drills, clay diggers, nail drivers, hitch cutters, cement guns, etc. **Independent Pneumatic Tool Co., Aurora, Ill.**

Marmon-Herrington Exhibit

THE ALL-WHEEL-DRIVE line for 1948, comprised of four regular heavy-duty models and the complete line of standard Ford models converted to All-Wheel-Drive, will be exhibited by Marmon-Herrington Co. Regular heavy-duty trucks feature both four-wheel-drive and six-wheel-drive models with gross vehicle weights up to 42,000 lb. Among the outstanding features of each of these models to be displayed are: the drop-type frame, with kick-up over the front axle, giving an extremely low center of gravity, and the forward placement of the front wheels providing a much better approach angle for getting up banks, out of ditches, etc. All-Wheel-Drive converted Fords are available in all standard models—passenger cars, station wagons and commercials converted to four-wheel-drive and larger truck models converted to four-wheel-drive and six-wheel-drive. **Marmon-Herrington Co., Inc., Indianapolis, Ind.**

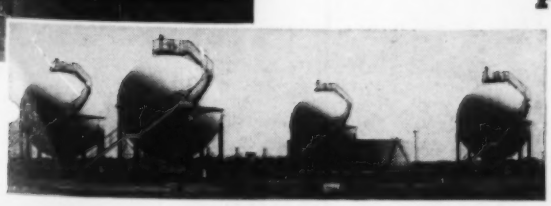
PITTSBURGH • DES MOINES



STEEL SPHERES

DESIGNED AND BUILT FOR THE STORAGE OF LIQUIDS AND GASES UNDER PRESSURE....

Provide better service and economy



Thoroughly researched, skillfully engineered and painstakingly fabricated, Pittsburgh-Des Moines Steel Spheres meet every performance requirement for pressure storage of your volatile liquids or gases—with definite economy benefits in operation. A consultation on your storage problems can develop pertinent, helpful facts toward their solution. *Let us cooperate with you!*

PITTSBURGH • DES MOINES STEEL CO.

PLANTS at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH..... 3470 Neville Island
NEW YORK..Room 951, 270 Broadway
CHICAGO 1274 First National Bank Bldg.
DES MOINES....971 Tuttle Street
DALLAS..1275 Praetorian Building
SEATTLE..578 First Avenue, South
SANTA CLARA, CAL.,.....677 Alviso Road

There's a Profitable Idea for You in—

The Case of the Old Offender

Draftsman: "You old reprobate, you spoiled a two hundred-dollar drawing! Look how brittle and opaque it is!"

Father time: "Yes, but you drew it on tracing paper — when you should have used Arkwright Tracing Cloth!"

It pays to use Arkwright Tracing Cloth instead of paper. It's a much safer habit, even for preliminary sketches and "one-job" drawings, supposedly temporary, that may be urgently needed later. Repeated usefulness and long years of permanence are your rich reward. This was dramatically proved when a perfect print was made recently from an 80-year old tracing on cloth made by the same process regularly employed by Arkwright!

Send for working samples and prove to yourself how much better Arkwright is for all drawings. Arkwright is sold by leading drawing material dealers everywhere. Arkwright Finishing Co., Providence, R. I.

The Big Six Reasons Why Arkwright Tracing Cloths Excel

1. Erasures re-ink without feathering.
2. Prints are always sharp and clean.
3. Tracings never discolor or go brittle.
4. No surface oils, soaps or waxes to dry out.
5. No pinholes or thick threads.
6. Mechanical processing creates permanent transparency.

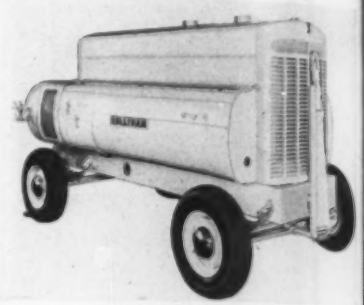
ARKWRIGHT

TRACING CLOTHS

AMERICA'S STANDARD FOR OVER 25 YEARS

Joy Construction Equipment

PROMINENT IN THE DISPLAY of the Joy Manufacturing Co., Sullivan Div., occupying booth 3001, will be six of the eight different sizes of the new WK-80 Series of portables—from the small 60 cfm size to the 630 cfm model. For heavy construction where infrequent moves are required, the Joy heavy duty WN-102 semiportable air compressor will be displayed and worked in slow motion through heavy, transparent lucite plates. The exhibit will also include: the line of Uni-



Portable Air Compressor

tair stationary air compressors used in building purposes where the air supply is stationary but not permanent; the latest Joy equipment for high-speed tunnel driving—two new rock bits, modern motor feed drifter drills, the jumbo mounting for drills called "Hydro-Drill-Jib," and the large shovel-type loader, model HL-20; a complete line of multi-purpose, single drum hoists and winches, both turbine and reciprocating air-driven models; a complete line of cadmium-plated rock drills, paving breakers, spaders and other pneumatic tools; wagon drills, and a complete line of parts and accessories. **Joy Manufacturing Co., Sullivan Div., Pittsburgh, Pa.**

FWD Truck

THE NEW MODEL ZU truck, announced in May by the Four Wheel Drive Auto Co., will be exhibited for the first time at the Road Show. The truck has a rating of 33,000 lb gross vehicle weight and has a number of advanced design features which will be of special interest. **Four Wheel Drive Auto Co., Clintonville, Wis.**

Wayne Sweeper

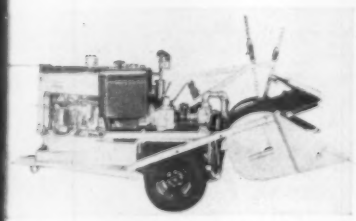
THE 2-YD motor pickup sweeper, manufactured by the Wayne Motor Sweeper, Div. of the Brown-Bevis Co., will be exhibited at the Road Show. Because of increased demands for the sweeper, the Company has purchased a plant in Pomona, Cal., and there the Wayne will be produced in great volume. **Wayne Motor Sweeper, Los Angeles 11, Cal.**

Marlow Pumps

CENTER OF ATTRACTION at the Marlow exhibit, Booth 1612, will be electric-driven, self-priming centrifugals, displayed in several sizes and featuring a new, compact vertical design. Also representing the line of construction pumps will be the new-type, lightweight aluminum models in 3M, 6M, and 12M sizes; electric and engine-driven models of other self-priming centrifugals; and diaphragm pumps in the Mud Hog series. Working models will be complemented by cut-aways emphasizing the Marlow free-flow design and other exclusive features. **Marlow Pumps, Ridgewood, N.J.**

Seaman Mixer

HIGHLIGHT of the Seaman Motors, Inc., exhibit, booth 3816, will be a diesel-powered mixer of the latest design. This new mixer will be equipped with spray bar, pump, and tachometer as well as with a clarifier attachment. Migration and evaporation losses are said to be virtually

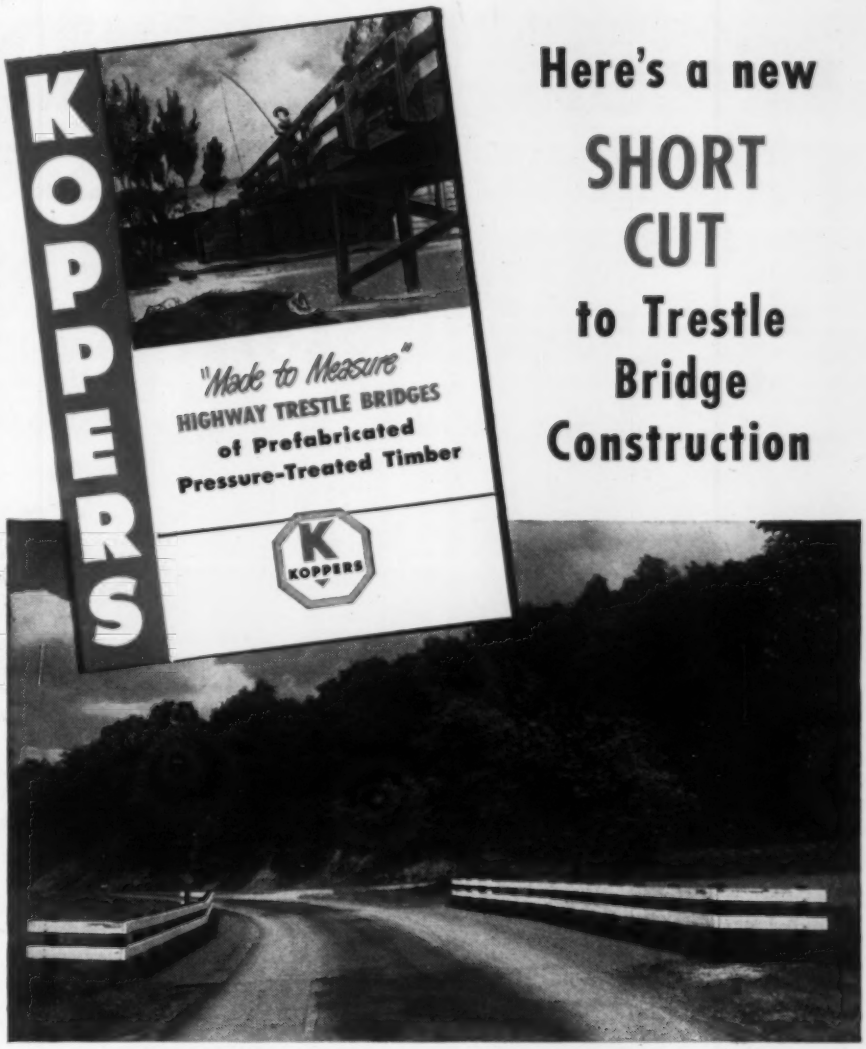


Diesel-Powered Mixer

eliminated by having the spray bar located just ahead of the mixing rotor so that oil or water is applied a fraction of a second before it is taken into the mix. Water or oil is piped from a supply truck operating either directly behind the mixer or at its side. In addition to the new mixer, the Company will exhibit other models especially built for highway shoulder construction. **Seaman Motors, Inc., Milwaukee, Wis.**

Austin-Western Equipment

THE CENTER OF THE Austin-Western display will be the 99-H power grader. In addition to all-wheel drive, all-wheel steer, precision side-shift, and controlled traction, the 99-H has 8 other outstanding features such as high-lift blade, extreme blade reach, completely reversible blade and full hydraulic control. Austin-Western will also exhibit the 55 motor-grader, especially designed for jobs not requiring heavier machines; two sizes of variable weight tandem rollers, incorporating many new improvements; autocrat rollers in both 10- and 12-ton sizes; the 101, largest single unit in a new line of portable crushing and screening plants; the ¾-swing design Badger convertible shovels; and the model 40 motor sweeper. **Austin-Western Co., Aurora, Ill.**



Here's a new

SHORT CUT to Trestle Bridge Construction

Now—the saving you can make with Koppers Pressure-treated wood for bridges *can start in the drafting room!*

Projects move to the quotation stage in a fraction of the time, and with a fraction of the detail work required before.

Detailed, dimensioned and blue-printed in the Koppers "Made-to-Measure" Bridge Book are a variety of abutment, bent, deck and railing types. They were selected after a study of a number of bridge designs, and include styles used in ordinary practice.

You pick the type desired . . . provide certain essential dimensional and site information on a data sheet . . . forward the sheet to Koppers Company for quotation. The finished bridge represents no compromise with the finest engineering principles, but merely utilizes the savings possibilities that come with standardization of parts and dimensions.

Members can be framed, treated and shipped to the job site all ready for assembly. Erection handled by regular crews of local labor, with no special equipment. The decay-protection of Koppers Pressure-treatment assures maximum life with minimum maintenance.

If you are concerned with trestle bridge construction, ask for a copy of the Koppers "Made-to-Measure" Bridge Book.

KOPPERS

PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PENNSYLVANIA

In the Field of Irrigation

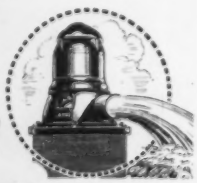
It is in the field of Irrigation that Layne Well Water Systems and Layne Vertical Turbine Pumps are most appreciated for their outstanding superiority of design, construction and quality. Of all places, the Irrigation field must have the utmost in dependability for long periods of continuous pumping. It is in this field that Layne water producing equipment is easily a 10 to 1 favorite in every case where ground water is used. Such leadership is highly complimentary to excellence of performance.

Basically, Layne Well Water Systems are extremely practical in design, and this design is noted for high efficiency. And supporting practical design and high efficiency, there is that well known Layne quality that assures longer life and practically no upkeep expense.

Layne Well Water Systems are designed for use in all situations where huge quantities of water must be produced at the lowest possible cost; packing houses, municipalities, factories, chemical processing plants, milk plants, petroleum refineries, railroads, etc.

For further interesting facts, literature, bulletins, etc., address

LAYNE & BOWLER, INC.
General Offices
MEMPHIS 8, TENN.

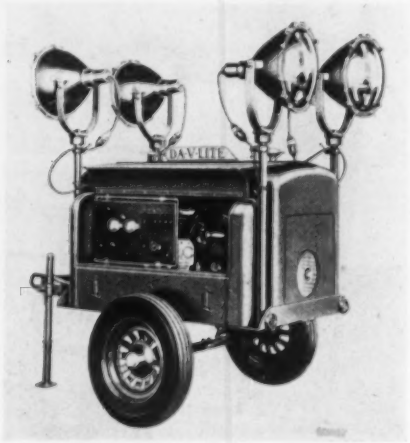


LAYNE
WELL WATER Systems

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Pacific, Inc., Seattle, Wash. * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minn., Minneapolis, Minn. * International Water Supply Ltd., London, Ont., Can. * Layne-Hispano Americana, S. A., Mexico, D. F.

Davey Compressors

THREE NEW COMPRESSOR MODELS and a Da-V-Lite portable lighting unit will be included in the exhibit of the Davey Compressor Co. Two of the compressors will be trailers, a model 105 gasoline engine powered Air Chief on two wheels, and a model 315 diesel, four-wheel Air Chief.



Da-V-Lite Compressor

Also on display will be the new "Mobile Construction and Repair Unit" mounted on a Dodge four-wheel drive power wagon. This includes a model 105 Auto-Air compressor and a combination generator. The Dodge Truck Division of the Chrysler Corporation is cooperating in this display. **Davey Compressor Co., Kent, Ohio.**

Yaun All Welded Products

A NEW DITCHING BUCKET, developed at the request of sugar plantation owners, will be featured by the Yaun Welding & Dragline Bucket Co. This bucket digs a sloping ditch ideal for irrigation or drainage purposes and can dig a ditch 600 ft long in one hour. Other all-welded products to be exhibited include the basket type bucket, the shell type buckets, perforated buckets, and a motorless tail gate spreader. **Yaun Welding & Dragline Bucket Co., Baton Rouge, La.**

Hyster Products

OCCUPYING OVER 42,000 sq ft, the Caterpillar Tractor Co.'s display, with the Hyster Co. participating, will be held on the south concourse. The Hyster Co. will show 14 tractor equipment machines including towing winches, tractor donkeys, cranes and the recently announced Hystaway, the tractor-mounted dragline, clamshell and crane. Three new pilot models of Hyster tractor equipment will be displayed for the first time. Circus tents will house a sound moving picture theater where products of the Caterpillar Tractor Co. and its allied manufacturer group will be shown. **Hyster Co., Portland, Ore.**

HYDRANTS & VALVES

Pipe Line Accessories for Water Works and Sewage Works

Write for Catalog No. 34

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS
GATE VALVES
TAPPING VALVES
WALL CASTINGS
SPECIAL CASTINGS
TAPPING SLEEVES
CHECK VALVES
FLOOR STANDS
EXTENSION STEMS
SHEAR GATES
MUD VALVES
VALVE BOXES
FLAP VALVES
SLUDGE SHOES
FLANGE AND FLARE FITTINGS
FLANGED FITTINGS
B & S FITTINGS
CUTTING-IN TEES

M&HVALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

Athey Construction Equipment

THREE NEW PIECES of construction equipment to be exhibited by Athey Products Corp. are the PD-10 rubber-tired quarry trailer equipped with large, single low-pressure tires for use with the Caterpillar DW10 tractor, and designed to handle tough rock moving jobs; the Force-Feed loader-portable crusher unit, designed primarily for towing behind the Athey Force-Feed loader, and providing a fast, inexpensive means of reclaiming and maintaining roads and streets; and the small capacity, 2-ton Forged-Trak wheels for use on industrial or agricultural equipment requiring greater flotation for soft, muddy and sandy operations. **Athey Products Corp., 5631 West 65th St., Chicago 38, Ill.**

Gorman-Rupp's Contractors' Pumps

THE COMPLETE NEW LINE OF Gorman-Rupp centrifugal self-priming contractors' pumps will be on display at booth 3021. These pumps have high-speed priming at high suction lifts at contractors' Pump Bureau ratings. The new 40M, 4-in. pump primes at 15 ft suction in 36 sec; at 25 ft in 1 min sec. The 90M, 6-in. pump primes at 15 ft in 21 sec; at 25 ft in 44 sec. The line includes pumps from the 7M, 2-in. to the 45M, 8 in. for use in the construction, mining, municipal, farming, oil producing, marketing and industrial fields. **Gorman-Rupp Co., Mansfield, Ohio.**

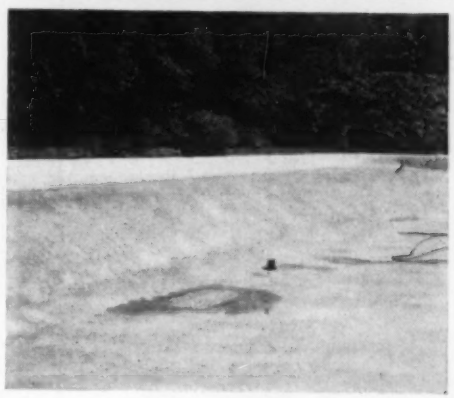
Gar Wood Equipment

SPEED AND REDUCTION OF COSTS will be the keynote of the Gar Wood exhibit in booth 3403. The Wayne Div. of Gar Wood Industries will feature: dump bodies with newly improved construction, the new 500-type hydraulic pump, the Load-Packer refuse body, the new Reel-Rite winch, the single lever control Rapid-Reverse winch, the new utility crane, and improved truck tanks. **Wayne Div., Gar Wood Industries, Wayne, Mich.**

Dotmar Curb Paver

AN IMPROVED MODEL mechanical curb and gutter paver, which will lay from 5 to 12 ft per min and up of curb and gutter, will be exhibited at the Road Show and demonstrated by A. P. Supject, developer of the machine. A special non-hardening mixture will be used for the demonstration. This versatile paver is readily adaptable to every type of curb and gutter paving as well as highway strip widening, and is said to reduce paving costs. **Dotmar Industries, Inc., Kalamazoo, Mich.**

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



RESERVOIR RELINED WITH "GUNITE"

The reservoir pictured at the left is at Hellertown, Penna. This old reservoir was originally lined with concrete which was badly cracked and disintegrated, resulting in serious leakage.

In 1945 we were awarded a contract to reline this reservoir with 2" mesh reinforced "GUNITE" with the result that the reservoir is now water-tight and better than new.

The upper photo shows the reinforcing mesh in place and the nozzle in operation. The lower photo shows the completed "GUNITE."

Our 72-page bulletin B2300 describes scores of "GUNITE" jobs. Write for your free copy.

MANUFACTURERS OF THE "CEMENT GUN"

FOUNDATIONS

PRETEST UNDERPINNING
CONCRETE-STEEL PILES
MASS CONCRETE CONSTRUCTION
HEAVY SHORING
DRILLED-IN CAISSONS

Send for catalogs descriptive of the latest foundation types and methods.

SPENCER, WHITE & PRENTIS, INC.
10 EAST 40th ST. NEW YORK 16, N.Y.

When Manpower *Waits . . .*

Losses pile up every time manpower is forced to lose productive minutes waiting for *doors* to be opened . . . standing by while traffic passes through . . . taking time to close them. You can easily stop these hidden profit leaks.

Manpower doesn't wait
when you install Kinnear Motor Operated Rolling Doors.

Push-button switches give you instant, complete, fingertip control of door action at all times, *from any number of convenient points.* It takes only a split-second of *manpower* to open or close the doors; the Kinnear Motor Operator does the rest, automatically.

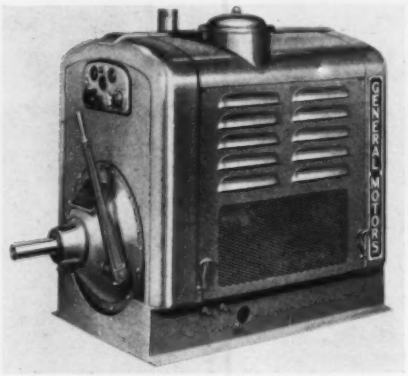
You also save *space* with Kinnear Rolling Doors. They coil out of the way, safe from damage by wind or vehicle, into a small area overhead. No wall, floor or ceiling space, is used as they open or close. All-steel construction gives you extra, low-maintenance service, added protection against fire, storm, theft. Any size, for old or new buildings. Write for details.

The KINNEAR Manufacturing Co.
Factories: 1780 Fields Ave., Columbus 16, O.
1742 Yosemite Ave., San Francisco 24, Calif.
Offices and Agents in all Principal Cities

Saving Ways in Doorways
KINNEAR
ROLLING DOORS

Detroit Diesel Power Plants

AN IMPRESSIVE SELECTION of GM Series 71 2-cycle diesel power plants will be shown in Booth 1001. Latest addition to the series 71 diesel line and feature of the exhibit is the Twin-4, a 236-hp multiple engine unit consisting of two 4-cylinder engines mounted together on a common base and geared to a single output shaft. Throttle and clutch control mechanisms are such as to permit the engines to be operated singularly or as a synchronized pair. Series 71, 349 hp, Twin-6, also being exhibited, is patterned



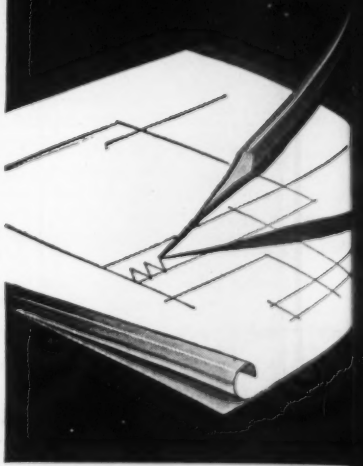
Model 4031C 4-Cylinder Engine

closely to the design of the Twin-4. Fan to flywheel type single engines of the 71 Series line include the following: A 58-hp diesel suitable for installation in compressors, welders, $^1/_2$-yd excavators and ditchers; a 93-hp, 3-cylinder engine for $^3/_4$-yd excavators; and a 183-hp vehicle type engine designed for off the road truck applications. Rounding out the engine display is a 120 hp, 4-cylinder, packaged display; a motion picture film entitled, "Diesel, the Modern Power"; and a chromium plated, rotating cutaway of a 3-cylinder, Series 71, diesel engine which will be electrically driven. **Detroit Diesel Engine Div., General Motors Corp., Detroit 28, Mich.**

Oliver Exhibit

A FULL LINE of Oliver Cletrac crawlers and wheel-type industrial tractors with allied equipment will be displayed by the Oliver Corp. The exhibit will feature the new cable bulldozer and trailbuilder equipment for Oliver's largest crawler-type tractor, the model "FDE." An entirely new principle in hydraulics is used to actuate the knife in a highway mower which will be shown to the public for the first time. The Sargent overhead shovel recently developed for the Oliver 900 wheel tractor will be included in the display. In addition, the 8-wheel tractor with Lull shoveloader and Allen cab will be presented. The 88 is comprised of an ultra-modern design engine, transmission with six forward and two reverse speeds, and Gemmer steering with central control. **The Oliver Corp., Chicago 6, Ill.**

TRACING CLOTH
for
HARD PENCILS



● Imperial Pencil Tracing Cloth has the same superbly uniform cloth foundation and transparency as the world famous Imperial Tracing Cloth. But it is distinguished by its special dull drawing surface, on which hard pencils can be used, giving clean, sharp, opaque, non-smudging lines.

Erasures are made easily, without damage. It gives sharp, contrasting prints of the finest lines. It resists the effects of time and wear, and does not become brittle or opaque.

Imperial Pencil Tracing Cloth is right for ink drawings as well.

IMPERIAL
PENCIL
TRACING
CLOTH

SOLD BY LEADING STATIONERY AND DRAWING MATERIAL DEALERS EVERYWHERE

KEY TO FAST ACCURATE ELEVATIONS

These are some of the outstanding features of the W & T Sensitive Altimeter

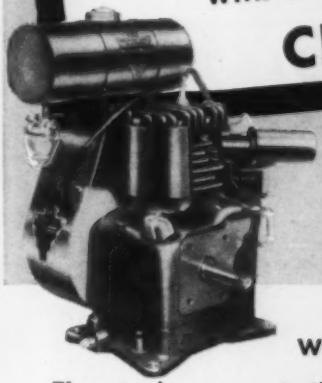
Accuracy . . . . . 1 part in 1000
Sensitivity . . . . . 1 part in 8000
Ranges . . . . . 0-2000 feet
0-7000 feet
and 0-16000 feet
Case . . . . . hardwood or metal

All types available in matched sets for ultra precision work. Write for technical literature.

A—68s

WALLACE & TIERNAN
PRODUCTS, INC.
ELECTRICAL MECHANISMS AND PRECISION INSTRUMENTS
BELLEVILLE 9 NEW JERSEY

MORE POWER
With a 4 Cycle Air-Cooled
CLINTON



2 Power Ranges
1½ to 2 H.P.
2½ to 3 H.P.

It's Powered BEST When CLINTON Powered

The sturdy, easy starting CLINTON Engine gives more power . . . dependable power . . . power when needed. Use its power for tractors, generators, small boats, bicycles, mowers, and innumerable other uses. At all times CLINTON Engines (sold world-wide . . . service everywhere) give peak performance under all conditions.

For full information write Dept. 100CE

CLINTON MACHINE CO.
CLINTON, MICHIGAN

Make Sure with a *Known* STANDARD!

Klemp

RIVETED OPEN STEEL GRATINGS

(Also made in aluminum)

Klemp Riveted Gratings are prefabricated. Cut to your exact specifications for regular or irregular floorings, mezzanines, runways—scores of uses. Forty years leadership insure their quality. Klemp also makes Welded Gratings for heaviest duty.

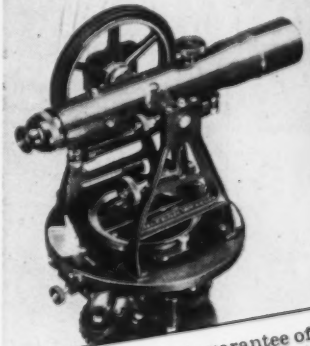
FIREPROOF SELF-CLEANING

Allows maximum passage of light and air.

Send for valuable new booklet "Open Steel Gratings and Stair Treads." Installations illustrated. Full engineering data. Also ask for catalogs on Hexteel heavy duty surface armor, and Floorsteel flexible floor armor that rolls out like a rug. Write

WM. F. KLEMP CO. "Steel Flooring Specialists"
6610 S. MELVINA AVE., CHICAGO 38, ILL.

7 reasons why so many engineers say "Give me a Gurley"



1. Unqualified guarantee of satisfaction.*
2. 103 years specialization in instrument making.
3. Field experienced engineering organization.
4. Service records of many Gurley craftsmen date back 25 to 50 years.
5. A completely modern plant for producing parts from the casting up—its own foundry, toolroom, complete optical facilities, collimator departments for final adjustments and testing.
6. A research department which has pioneered many improvements in surveying instruments.
7. Prompt handling of orders and repairs.

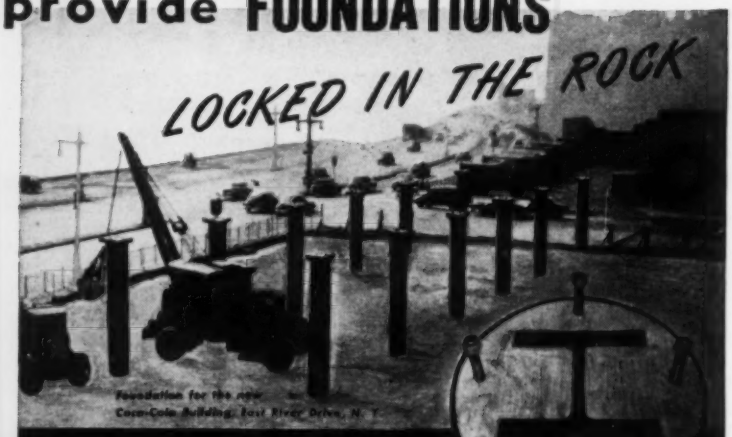
You buy with confidence at Gurley, as have four generations of engineers before you. Our condensed catalog, Bulletin 50, gives full details. Send for it today.

W. & L. E. GURLEY · 518 Fulton · Troy, N. Y.

*GURLEY'S CENTURY-OLD GUARANTEE—"No transaction is ever considered closed where any dissatisfaction is known to exist on the part of the customer, who is assured of courteous and fair treatment without regard to the extent of his business."

GURLEY
Surveying and Scientific Instrument Makers
Since 1845

DRILLED-IN CAISSONS
provide FOUNDATIONS
LOCKED IN THE ROCK



Foundation for the new Coca-Cola Building, East River Drive, N. Y.

The latest development in the art of foundation construction, the Drilled-In Caisson can be installed through any overburden into rock at any depth. . . . Individual caissons have been used to carry loads up to 1500 tons. Write for catalog. . . .

DRILLED-IN CAISSON CORPORATION
2 PARK AVENUE, NEW YORK 16, N. Y.
Affiliated with

SPENCER, WHITE & PRENTIS, INC.
10 East 40th St.,
New York 16, N. Y.

WESTERN FOUNDATION CO.
2 Park Ave., New York 16, N. Y.
308 West Washington St., Chicago, Ill.

The Drilled-In Caisson Corporation is equipped to make soil explorations by the latest methods; to furnish geological reports; and to provide soil mechanic determination.

MacArthur
38 YEARS INSTALLING PILES
OF EVERY TYPE
CAST-IN-PLACE
CONCRETE
COMPOSITE
STEEL
SECTIONAL PIPE
TIMBER
SOIL AND ROCK BORINGS

MacArthur
CONCRETE PILE CORP.
18 EAST 48th STREET
NEW YORK 17 N Y
BOSTON
CINCINNATI • NEW ORLEANS

TIDE GATES

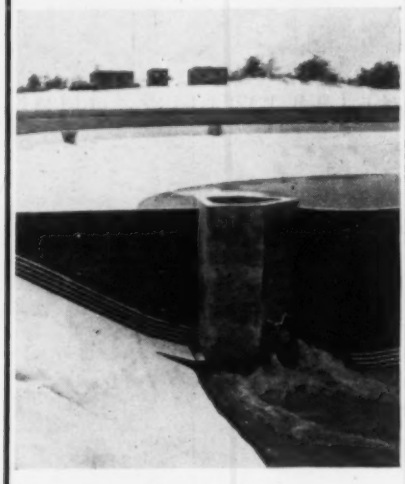


Fig. B-144-A

One of Two 48" Type M Gates installed in Ft. Stanton Park Reservoir, Washington, D. C., to maintain direction of flow. See Feb. 22, 1944, issue Engineering News Record for story about this project.

BROWN & BROWN, INC.
LIMA, OHIO, U. S. A.

Blaw-Knox Construction Equipment

SIMULATED ROAD-BUILDING will ture Blaw-Knox construction equipm A precision subgrader, a vibratory spre and a vibratory finisher will operate team on a 100-ft paving setup. O operating machines will be a recently proved widening finisher and a port 200-barrel cement batching plant. display will be a new automatic cen weighing batcher and a new autom aggregate weighing batcher, truck mi articulated flexible face forms, an Blaw-Knox insulated steel building of fabricated type which will use Alumid as canopies on one side of the build Movies will show the uses of Blaw-K construction equipment. **Blaw-Knox Pittsburgh, Pa.**

Parsons Trenchliners

OF PRINCIPAL INTEREST to visitors the Parsons Co. display, a part of Koehring exhibit, will be the model utility-size trenchliner, which offers a method of excavating off-street serv connections. The model 221, ladder-ty trenchliner with 25 digging speeds, capable of excavating trenches 16 in. 36 in. wide, 8 ft, 6 in. deep; and the la model 200 wheel-type trenchliner with complement of digging equipment **Parsons Co., Newton, Iowa.**

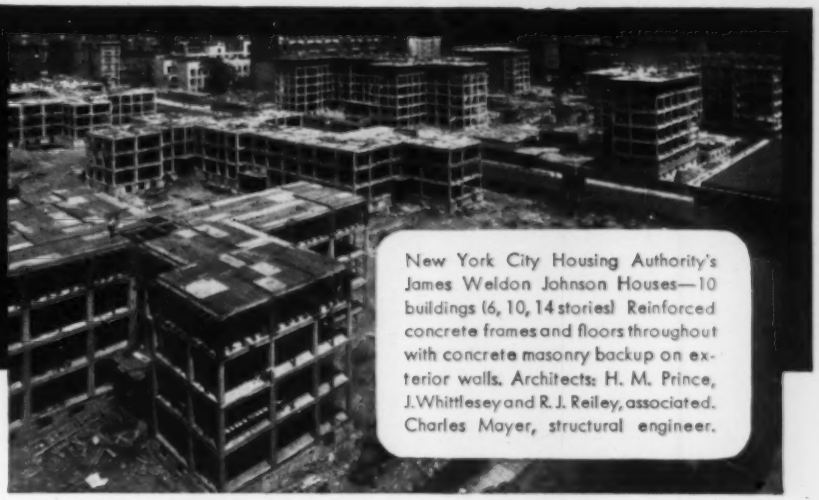
Johnson Products

AGGREGATE AND CEMENT-HANDLI equipment manufactured by the C. Johnson Co. will be included in the Koeh ing exhibit. The Johnson display include: the All-Purpose bin, an welded, 3-compartment aggregate bin signed with extra large fill valves for hi speed batching; the Lo-Bin trol batcher; the elevating charger offering efficient method of unloading cement; a complete line of all-welded bucke **C. S. Johnson Co., Champaign, Ill.**

Wisconsin Air-Cooled Engine

AN OUTSTANDING FEATURE of the exhi of the Wisconsin Motor Corp. will be animated display unit headlined by new trademark, "Most H. P. Hours This unit will also include translite p tures of various engine power appli tions. The company's entire line will exhibited and cutaway models of all th types of engines will be shown. T latest additions to the Wisconsin line, models TE and TF 2-cylinder engines, w be among those exhibited. **Wisconsi Motor Corp., Milwaukee, Wis.**

xtra Housing Units through CONCRETE ECONOMY



New York City Housing Authority's James Weldon Johnson Houses—10 buildings (6, 10, 14 stories) Reinforced concrete frames and floors throughout with concrete masonry backup on exterior walls. Architects: H. M. Prince, J. Whittlesey and R. J. Reiley, associated. Charles Mayer, structural engineer.

HOUSING budgets yield the maximum number of units when you take advantage of the economy of reinforced concrete frame and floor construction.

Reinforced concrete construction results in fire-safe buildings with the strength and rigidity to resist all static and dynamic loads. It is ideally adapted to hospitals, hotels, schools, office and apartment buildings and industrial structures. It permits a reduction in total building height without reducing ceiling heights, offers unusual freedom in design and cuts building cost.

Architects and engineers are invited to write for copies of two free reference manuals: "Continuity in Concrete Building Frames" and "Handbook of Frame Constants." This literature is distributed only in the United States and Canada.

PORTLAND CEMENT ASSOCIATION Dept. 7-13, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of portland cement and concrete... through scientific research and engineering field work

A Suggestion to Civil Engineers in Industry

Let your own official periodical do a selling job for your product or service.

CIVIL ENGINEERING
PUBLISHED BY THE AMERICAN SOCIETY OF CIVIL ENGINEERS
33 West 39th Street, New York 18, N. Y.

To Save Even One Life- Who'd Count The Cost?
YOU CAN DO BOTH WITH
IRVING DECKING
The Safest as well as the most Economical
BRIDGE FLOORING
To learn How and Why- write for catalog

IRVING DECKING on Rural Fixed Span

IRVING SUBWAY GRATING CO., INC.
ESTABLISHED 1902
Home Office and Plant: 5008 27th Street
LONG ISLAND CITY 1, NEW YORK
Western Division: Foot of Park Ave.
EMERYVILLE 8, CALIFORNIA

UNDERPINNING AND FOUNDATION CO

FOR 40 YEARS
DIFFICULT FOUNDATIONS
HERCULES STEEL PILES
UNDERPINNING
NO JOB TOO LARGE . . .
. . . NONE TOO SMALL
FREE CONSULTATION
SEND FOR CATALOG

155 E. 44th Street
New York 17, N. Y.

Meet The Lightweight TUNNEL CHAMP!

On a pound-for-pound basis ARMCO Tunnel Liner Plates are in a class by themselves. They save you money and speed the job.

These sturdy plates are designed for utmost strength with the least possible weight. One unskilled workman can carry, hold and bolt into place an ARMCO Liner Section. Only a structural wrench is needed. Labor costs are low and the job goes fast. Less bulk also means less excavation, and storage requirements are smaller. With ARMCO Plates you buy no excess metal, and this keeps job costs down.

Consider tunneling that next job with the aid of ARMCO Tunnel Liner Plates. You'll find it the simplest, most inexpensive way you ever saw to install conduits, sewers and similar structures. The hazards and inconvenience of open trenches are avoided and business above ground goes on as usual. Write for prices and complete information on your specific needs. Armco Drainage & Metal Products, Inc., 1965 Curtis Street, Middletown, Ohio.

ARMCO
TUNNEL LINER PLATES

ARMCO

Literature Available

TOURNAHAULER—A six-page illustrated folder, RT-149, describes the new heavy-duty, self-powered hauling unit called the Tournahauler. The folder discusses the design of the machine and how it meets individual requirements and how, though engineered for both long and short hauls, it will demonstrate versatility under the adverse conditions of off-road operations. **Tournalayer Div., R. G. Letourneau, Inc., Longview, Tex.**

SOIL STABILIZATION—A 23-page, profusely illustrated catalog explains the Seaman system of soil stabilization. More than 40 action photographs show many unusual and interesting operations and the text offers quickly understood, time-saving explanations. Among the subjects described other than road mixing are brush and root removal in land clearing work, methods of obtaining higher densities in earth fills, preparation of grass seed beds and mulching for shoulders, back slopes and landscaped areas, as well as the use of the Seaman mixer in clearing ice from streets and highways. **Seaman Motors, Inc., 298 N. 25th St., Milwaukee 3, Wis.**

VALVE BOOKLET—"Crane Valve World" is a review of advances made in steel founding, particularly in relation to castings for valves and fittings. Among the sections included are the following: a new alloy valve line designed for corrosive services, production of viscose rayon and its uses, and shop unit fabrication of piping and valves. **Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.**

KONIK METAL—An 8-page folder entitled "Konik Metal" includes: a description of the product, a discussion on its use for culverts, drains, etc., proofs of its excellence, related charts, and a summary showing that Konik metal is efficient, enduring, and economical. **Continental Steel Corp., Kokomo, Ind.**

STRAIN GAGE INSTRUMENTS—A 4-page, illustrated folder describes the 24-channel strain gage instruments developed for convenient and rapid reading of strains in multiple wire resistance strain gage test arrangements. How each instrument operates and its outstanding features are included. **Anderson-Fluke Engineering Co., P.O. Box 815, Stamford, Conn.**

GAS SAFETY EQUIPMENT—Bulletin No. 221 presents an improved line of sludge gas safety equipment. The gas safety equipments are shown in engineering drawings; sectional views of sufficient size to reveal all details plainly. Presented in this manner, with explanatory text, are flame traps, pressure relief with waste gas flame trap, pressure relief, waste gas burners, pilot line flame cells, gas pressure indicating gages, low pressure check valves, manually operated drip trap and accumulator for condensate and sediment. Typical gas piping arrangements for single and multiple digester installations are also shown in drawings. Specifications and charts for the selection of sizes are included. **Pacific Flushing Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.**

Economical tunnel driving under any ground condition, depends largely on the support used. Wood is the common support, cheap once, but always hard to shape and install, it always requires excess excavation beyond the "Pay Line," COMMERCIAL PIONEER Liner Plates are easy to handle and install because they are prefabricated to the correct radius — excavation is right to the "Pay Line" and they can be used in all types of ground.

Engineers should write "Commercial Liner Plates" in their tunnel specifications.

THE COMMERCIAL SHEARING & STAMPING C
P. O. BOX 719 YOUNGSTOWN 1, OHIO

How do you compute

YOUR VERTICAL CURVES?

Engineers of forty eight states use the E-Z-V-C Tables to simplify and expedite the computation of vertical curve externals. They will simplify your calculations, too. Price, $1.00 per copy.

P. O. Box 3278, Sta. "F"
E-Z-V-C TABLES
ATLANTA, GA.